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VOLUME 19 No. 2 **AUGUST 1997**

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COVER PICTURE

The Isle of Man Steam Railway is a gem in British narrow gauge railway preservation, providing inspiration to model engineers of locomotives and rolling stock in all scales. No. 4 'Loch', built to 3 ft gauge by Beyer Peacock, brings an afternoon train through Oakhill Cutting shortly after leaving Douglas. Photograph by Paul Stratford.

IN NEXT MONTH'S ISSUE

Robert Morrison's Three Ton Double Acting Steam Hammer
The Sheldon Compound Steam Engine
The Robey No. 4 Light Traction Engine
LNWR 0-6-2T 'Coal Tank' Locomotive in 5" gauge
LNER 20 ton Brake Van
Constructing a Year-Going Longcase Clock

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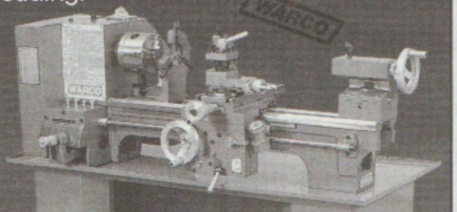

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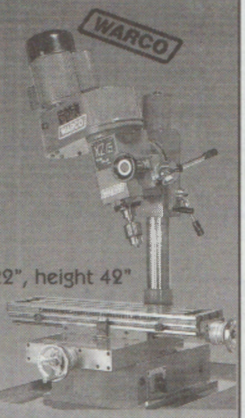

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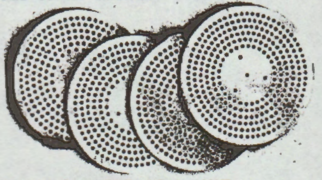

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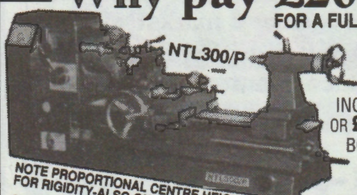

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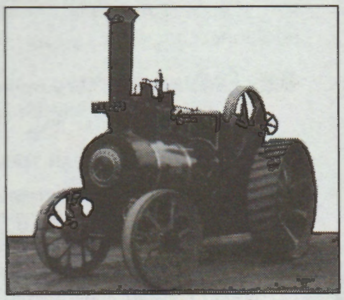

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[illegible] Compact 5 CNC Lathe Mark 4, 1ph, 6 Tool Turret	£2650.00
[illegible] Compact 5 CNC, 6 Tool Turret, 1ph, VGC, Mark 4	£2225.00
[illegible] Compact 5 CNC, 6 Tool Turret, 1ph, VGC, Upgraded to Mark 4.	£2000.00
[illegible] Centre Lathe, 1ph, Camlock Spindle, Tooling, VGC	£3500.00
[illegible] Lathe, Milling Head, Tooling, 3ph	£1200.00
[illegible] Lathe, 3ph with phase converter fitted, vgc	£650.00
[illegible] Lathe and Tooling	£600.00
[illegible] 4.1/2" x 18", Very Well Tooled, 1ph, Choice of 2..	£1000.00
[illegible] 4.1/2" x 24", Very Well Tooled, 1phase, GC, Choice.	£1000.00
[illegible] Model C, 4.1/2" x 18", 3ph, 3 Jaw Chuck	£350.00
[illegible] 4.1/2" x 18", 3ph, Plain Lathe	£350.00
Colchester [illegible] 5" x 20" Lathe, 3ph	£1250.00
Colchester Student Round Head 6" x 25", Tooling, Choice of 4	£1100.00
[illegible] Centre lathe, 6" x 40", 3ph, Gap Bed, Choice of 3	£3000.00
[illegible] 11" Centre Lathe, Tooling, Norton Box, 3ph	£1250.00
[illegible] Lathe, Well Tooled, Single Phase	£1100.00
[illegible] Lathe & Tooling, VGC	£950.00
[illegible] Variable Speed Lathe, 3ph	£750.00
[illegible] Model M Lathe & Tooling, 1ph	£750.00
[illegible] Model L Plain Lathe, 3ph	£500.00
[illegible] Toolroom Lathe, Tooled	£1000.00
[illegible] Lathe Bed & Headstock only	£100.00
[illegible] Lathe Bed, Headstock & Tailstock only	£200.00
[illegible] CNC Lathe, Manuals, Tools, VGC, 1phase	£850.00
[illegible] Computer Co Bench Lathe, 1ph, FAULT !	£500.00

DRILLING MACHINES

[illegible] Floor Standing Pillar Drill, 5 speed, 3ph	£250.00
[illegible] Pillar Drill, 3ph	£250.00
[illegible] Pillar Drill, 3ph, VGC	£325.00
[illegible] High Speed Bench Drill, 0 – 1/4" Cap., 3ph	£150.00
[illegible] Drill Press (unused)	£150.00
[illegible] Bench Drill, 1ph, VGC	£265.00
[illegible] 1/2" Cap. Bench Drill, 3ph	£175.00
[illegible] Bench Drill, fitted speed reducer, 3ph	£250.00
[illegible] Drilling Machine for restoration,	£50.00
[illegible] Vibrating Tapping Machine	£500.00
[illegible] Tapping Machine 5/8" Cap. (large, old)	£250.00
[illegible] Pillar Drill, 3ph	£200.00

MILLING MACHINES

[illegible] CNC Milling Machine, 1ph	£3500.00
[illegible] Turret Mill, Varispeed Head, DRO, Power Feed, 3ph	£3750.00
[illegible] Turret Mill, Power Feed, 3ph	£2000.00
[illegible] Turret Mill, 3ph, Long Table With Power Feed, 30 Int, Old	£1000.00
[illegible] Vertical Mill, Swivel head, Vice, 3 MT, 3ph, VGC, Manual	£1200.00
[illegible] Vertical Mill, 30 Int Spindle, 3ph, Immaculate	£1600.00
[illegible] Vertical/Horizontal Milling Machine, Power Feed, 3ph	£1650.00
[illegible] Vertical Turret Type Mill, R8 Spindle, Power Feed, 3ph	£2250.00
[illegible] Horizontal/Vertical, Vice, Chuck, Single Phase	£1450.00
[illegible] Horizontal/Vertical, VGC, 3ph, Choice of 2	£1250.00
[illegible] Horizontal Mill, 3ph	£500.00
[illegible] Mill, Vice, 1ph	£950.00
[illegible] Jig Borer with Tooling, DRO, Neisa Guards.	£1500.00
[illegible] Jig Borer, 1ph, tooled	£850.00
[illegible] 3ph, Type Manual, Excellent Condition	£1500.00
[illegible] Engraver, 1ph, VGC	£1750.00

POWER HACKSAWS

[illegible] Bandsaw, Single Phase, Excellent Condition	£1500.00
[illegible] Power Hacksaw, 1ph	£350.00
[illegible] Power Hacksaw, 3ph	£350.00
[illegible] Power Hacksaw, 3ph	£350.00
[illegible] Power Hacksaw	£500.00
[illegible] Horizontal Bandsaw, 3ph	£550.00
[illegible] Power Hacksaw, 3 ph	£275.00
[illegible] Saw, Coolant, Vice, 1HP, 1 Phase, NEW	£385.00
[illegible] Horizontal Band Saw, 1ph, 4 Speed, (List £2650)	£1950.00
[illegible] Horizontal Band Saw, 1ph, 4 Speed, (List £890)	£625.00
[illegible] Automatic Cold Saw, 3ph	£1000.00
[illegible] Power Hacksaw, 3 phase	£300.00

GRINDERS, LINISHERS, POLISHERS

[illegible] Grinder, 18" x 6", Mag Chuck, 3ph	£650.00
[illegible] Grinder, 18" x 6" Cap., Mag Chuck, 3ph, Choice	£750.00
[illegible] Tool & Cutter Grinder, well tooled.	£1250.00
[illegible] Tool and Cutter Grinder, Bench Mounting, 1ph	£650.00
[illegible] Tool and Cutter Grinder, Cabinet, Tooling, 3 ph	£800.00
[illegible] Bench Grinder (3ph)	£50.00
[illegible] Pedestal Grinder, 3ph	£125.00
[illegible] Double Ended Buffer, 3ph	£250.00
[illegible] Double Ended Buffer, 3 ph, 1HP	£300.00
[illegible] Buffer/Grinder, 3ph	£225.00

SHAPERS

[illegible] Hydraulic Shaper, 180mm stroke	£350.00
[illegible] Shaper, 3ph	£300.00
[illegible] Shaper, 3ph	£450.00
[illegible] Shaper, 3ph	£450.00
[illegible] Shaper, Vice, 3ph	£250.00
[illegible] Shaper with Vice, 3ph	£400.00
[illegible] Tilting Table for Elliott Shaper	£100.00
[illegible] Shaper, 3ph	£450.00

[illegible] SPARES & TOOLING.

[illegible] Change Gears (Southbends).
[illegible] 22T-£11, 23T-£11, 24T-£11,
[illegible] 31T-£12, 32T-£12, 35T-£12,
[illegible] 41T-£14, 43T-£14, 44T-£14,
[illegible] 52T-£15, 53T-£15, 54T-£15,
[illegible] 71T-£18, 75T-£18, 79T-£18,
[illegible] 127T-£30.

[illegible] Compound Gear	£55.00
[illegible] Compound Gear	£30.00
[illegible] Compound Gear	£35.00
[illegible] Reverse Gear	£12.00
[illegible]	£15.00
[illegible]	£20.00
[illegible]	£18.00
[illegible]	£38.00
[illegible] 4 Jaw Chuck	£75.00
[illegible] 4 Jaw Chuck	£85.00
[illegible] Cross Slide Nuts (New)	£38.00
[illegible] Cross Slide Screws (New)	£88.00
[illegible] Lathe Cabinet	£100.00
[illegible] Adaptor & Nose Cap	£85.00
[illegible] Saddle Assembly with Power Crossfeed	£200.00
[illegible] Switch Kit	£40.00
[illegible] 1 phase 240 volt electric motor	£150.00
[illegible] Switch for above	£32.00
[illegible] Saddle & Apron parts available	POA
[illegible] Headstock Sleeve	£8.00
[illegible]	£125.00
[illegible] A, B, C, AUD, BUD, [illegible] (New)	£90.00
[illegible] Change Gear Cover	£40.00
[illegible] Change Gear Quadrant	£15.00
[illegible]	£45.00

[illegible] SPARES AND TOOLING.

[illegible] Change Gears:
[illegible] 35T-£5.00, 38T-£6.00,
[illegible] 60T-£9.00, 65T-£9.00,
[illegible] 100T-£14.00, 127T-16.00

[illegible] Quick Change Toolpost (4 holders) New	£125.00
[illegible]	£40.00
[illegible]	£25.00
[illegible]	£15.00
[illegible]	£15.00
[illegible] Collet Chuck & 8 Collets	£250.00
[illegible]	£25.00
[illegible] (for use with capstan att.)	£85.00
[illegible] Capstan Att., immaculate, fit S7 or ML7.	£500.00

[illegible] SPARES AND TOOLING.

[illegible]	£10.00
[illegible]	£15.00
[illegible]	£20.00
[illegible]	£25.00
[illegible]	£30.00
[illegible]	£35.00
[illegible]	£40.00
[illegible] 120T, 125T Nylon	£45.00
[illegible]	£50.00
[illegible]	£60.00
[illegible]	£35.00
[illegible]	£85.00
[illegible]	£75.00
[illegible]	£20.00
[illegible]	£15.00
[illegible]	£22.00
[illegible]	£20.00
[illegible]	£50.00
[illegible]	£75.00
[illegible]	£30.00
[illegible] handwheels	Each £15.00
[illegible] from	£3.00
[illegible]	£55.00
[illegible]	£65.00
[illegible]	£50.00
[illegible]	£40.00
[illegible]	£125.00
[illegible]	£20.00
[illegible]	£100.00
[illegible]	£75.00
[illegible]	£125.00
[illegible]	£20.00
[illegible]	Each £15.00
[illegible] Attachment, unused	£500.00
[illegible] Attachment, unused	£150.00

COLCHESTER SPARES AND TOOLING

Colchester Triumph 2000 Fixed Steady	£175.00
Colchester Triumph 2000 Travelling Steady	£75.00
Colchester Triumph 2000 7" Catchplate	£30.00
Colchester Triumph 2000 14" Faceplate	£100.00
Colchester Triumph 2000 Headstock Sleeve	£35.00
Colchester Triumph 2000 S\C Gearbox Casing + a few parts	£150.00
Colchester Bantam\Chipmaster Tailstock	£125.00
Colchester Student 1800 Fixed Steady	£150.00
Colchester Student 1800 Roundhead Headstock Sleeve	£20.00
Colchester Student 1800 Rack (new)	£75.00
Colchester Student 1800 Screwcutting Gearbox	£225.00
Colchester Student 1800 Headstock Internal Gears	£POA
Colchester Student Roundhead Gap Piece	£50.00
Colchester Student Roundhead Rack	£25.00
Colchester Student Roundhead Thread Dial Indicator	£35.00
Colchester Student Roundhead American Toolpost	£20.00
Colchester Student Roundhead Headstock sleeve	£25.00
Colchester Student Roundhead Change Gears (Various Sizes)	Each £15.00
Colchester Student Roundhead Travelling Steady	£30.00
Colchester Master 2500/Student 1800 12" 4 Jaw Chuck	£150.00
Colchester Triumph Roundhead 14" Faceplate	£75.00
Colchester Triumph Roundhead 12" 4 Jaw Chuck	£100.00
Colchester Triumph Roundhead Tailstock	£150.00
Colchester Mascot Roundhead 20" Faceplate	£100.00
Colchester Mascot Roundhead 12" 4 Jaw Chuck	£100.00
Colchester Mascot Roundhead 10" Catchplate	£30.00

MACHINE ACCESSORIES

OMT 16" Horizontal/Vertical Rotary table	£500.00
OMT 10" Optical Rotary Table, VGC	£200.00
OMT 12" Inclinable Rotary Table	£350.00
Vertex 6" Horizontal/Vertical Rotary Table, NEW	£135.00
Hofmann 8" Rotary Table, VGC	£275.00
Criterion 6" Rotary Table	£250.00
Elliott 15" Rotary Table	£250.00
Bessboro SWR2 325mm Swivel & Tilt Rotary Table	£350.00
Taylor Hobson Inclinable 6" Rotary Table	£225.00
Abwood 8" Swivel and Tilt Rotating Table	£250.00
Elliott U1/U2 Rack Dividing Attachment	£150.00
Apex 4" Swivel & Tilt Machine Vice (as new)	£150.00
Abwood 6" Swivel & Tilt Vice	£250.00
Spencer Franklin 150mm Power Lock S/C machine vice, vgc	£200.00
Apex 4" Universal Vice (as new)	£150.00
Marlco Indexer and 7 collets (1.3/4" Cap.)	£250.00
Carl Zeiss 130mm Optical Dividing Head and tailstock	£450.00
Thiel/Ruhla Dividing Head	£300.00
Cooke Troughton and Simms Optical Inspection Dividing Head	£500.00
Hofmann 5" Dividing Head & Tailstock	£400.00
Swivel Vertical Milling Head (Large), 4MT	£150.00
Elliott Sturdimill 1250 Slotting Head	£350.00
Monks & Crane SL1 Cutter Grinding Attachment	£75.00
Thoka Arbo No.2 2MT 6 Station Turrett Drill Attachment	£250.00
30 INT Stub Arbors to Take Shell End Mills, Good Range	£30.00
Clarkson 30 INT FC3 Cutter Holder	£25.00
Osbom Titanic 3 MT Milling Chuck, 4 Imp Collets	£85.00
Sandvik R8 Shell End Mill Holder	£45.00
Albrecht 1/2" cap. Keyless Drill Chuck, R8 Shank	£55.00
R8 Str Shank Cutter Holders, 1/8", 1/4", 3/8", 1/2", 1", 5/8"	Each £22.00
R8 Collets 1/8", 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", 5/8", 3/4"ea	£12.00
Clarkson R8 S Type Autolock Chuck, 4 Metric Collets	£135.00
Osbom Titanic R8 Milling Chuck & 4 Collets	£85.00
Clarkson 30INT C Type Autolock Chuck, 4 Imp Collets	£65.00
Clarkson 30 INT Autolock Chuck (small) with 4 collets	£85.00
Clarkson 40 INT C Type Autolock Chuck (large) 2 Imp Collets	£65.00
Clarkson 40 INT Autolock Chuck (large) with 2 collets	£100.00
Clarkson 40 INT Autolock Chuck (small) with 4 collets	£80.00
Clarkson 40 INT Dedlock 200 chuck	£50.00
Clarkson 40 INT FC3 Holder	£25.00
Clarkson Large/Small Adaptor & 4 collets	£100.00
Alfil 45 INT Collet Chuck(unused)4 small metric collets	£75.00
Clarkson 50 INT Autolock chuck (lge) 2 imp collets	£100.00
Clarkson 50 INT Autolock chuck (small) 4 imp collets	£85.00
Clarkson 50 INT Dedlock 200 chuck	£85.00
Clarkson 50 INT FC3 holder	£45.00
Titanic 50 INT milling chuck and 4 small collets, imp	£75.00
Bristol Erickson Acramill 50INT collet chuck - large	£125.00
Clarkson 4MT Dedlock 150 Chuck	£75.00
Osborne Titanic 4MT Chuck (lrge) 2 Imp collets	£85.00
Clarkson 3MT C Type Autolock Chuck (lrg) 2 imp collets	£75.00
Clarkson 3MT S Type Autolock Chuck (lrg) 2 imp collets	£100.00
Clarkson 4 MT Autolock chuck (lge) 2 imp collets	£80.00
Clarkson 5 MT Autolock chuck (small) 4 met. collets	£80.00
Clarkson Autolock Chuck Collets	Large Each £15.00
Clarkson Autolock Chuck Collets, Small, Imp, ..Each £15.00.Metric	£20.00
Modeloy 3MT Light Duty Milling Chuck, 3 Imp Collets	£65.00
Mikron 52mm Headstock collets	Each £25.00
40 INT-1, 2, 3, 4 MT adaptors	Each £25.00
Toolmex 40INT 20" Milling Arbor (Boxed, Unused)	£125.00
50 INT-2, 3, 4 MT, 40INT adaptor	Each £30.00
50 INT horizontal milling arbor	£50.00
R8-3MT and R8-2MT Adaptors	£22.00
Precise 60 Piece Spacing Collar Set, 1" Bore (8 Pce.Missing)	£75.00
Precise 56 Piece Spacing Collar Set, 1.1/4" Bore	£125.00
Precise 60 Piece Spacing Collar Set, 1.1/4" Bore	£125.00
B C A Offset Boring Head, fits BCA Jig Borers, vgc	£100.00
Lushington 40INT Boring and Facing Head	£250.00
Lushington No2 Precision Offset Boring Head, 4 MT Shank	£65.00
A B Creed 4 MT Boring Head	£150.00
Super 40 INT Boring and Facing Head	£250.00
Gamet Boring and Facing Head, 30 INT Shank (Removable)	£250.00
J and S Hatch R8 Boring Head, Box	£125.00
Wohlhaupter UPA3 Boring & Facing Head, 9 B&S Shank	£375.00
Wohlhaupter UPA4 Boring & Facing Head (Fits Dixi Jig Borer)	£450.00
Wohlhaupter UPA4 Boring and Facing Head, 40 INT Shank	£575.00
Wohlhaupter UPA5 Boring & Facing Head, 5MT Shank	£600.00
UBS GR Boring and Facing Head, 4MT Shank, Boxed, Accesories, VGC	£250.00
Newall 4MT Boring & Facing Head, Very Well Equipped, VGC	£400.00
Huron Precision Boring and Offset Boring Head, 40INT, Cased	£225.00
Armag 4MT Boring & Facing Head for irregular bores	£300.00
Bridgeport No 2 Boring Head, R8 Shank	£125.00
Lockwood 2MT Micro boring head (new)	£75.00
Criterion K3, 4MT, 1" Capacity Reversible Tapping Head, VGC	£275.00
Marlco Adjustable Pitch Circle Drilling Fixture,	£250.00
Slack & Parr Type A36/2 3 spindle Drill Head	£200.00
Ackworthie-Goliath 4 spindle drill attachment, 1MT	£100.00
Coventry Type CH 1/2" Die Head	£75.00
Coventry Type CH 1" Die Head	£75.00
Coventry Type CH 1.1/2" Die Head	£100.00
Coventry Type CHS 1.1/2" Die Head	£150.00
Herbert Chaser Grinding Attachment, 1 1/2" Diehead Chasers	£150.00
Herbert Chaser Grinding Attachment, 1.1/4" Diehead Chasers	£125.00
Herbert Chaser Grinding Attachment, 1" Diehead Chasers	£100.00
Set of 4 Woden Straight Lathe Carriers, 1/2"-1.1/4"	£15.00
Set of 6 Jones & Shipman Straight Lathe Carriers, ...1/2"-2"	£25.00
Jones & Shipman Tap Relieving & Sharpening Att., VGC	£400.00
Jones & Shipman Radius Dresser	£150.00
SMP Floating Chuck (30mm Shank)	£85.00
Pratt 12" 4 jaw chuck L2 fitting	£150.00
Toolmex 12" 3 Jaw Chuck, Backplate Mounting	£200.00
Burnerd Multisize Collet Type M2, 3, 6	Each £20.00
Burnerd Multisize Collet Type MB8, 10, 11	Each £25.00
Union Mafg.Co 6" Independent self centering 3 jaw chuck	£75.00
Jaws for P/B 6 Jaw Chuck, fit 250mm chuck, Pt No 2658-26884	£75.00
Burnerd 548BLK Soft Jaws (fit 10 1/2"-12" 3 jaw chuck)	£25.00
Burnerd 308BLK Soft Jaws (fit 4" 3 jaw Chuck)	£20.00
Toolmex 160mm 3 Jaw Chuck (Unused)	£125.00
SCA 250mm 3 jaw chuck, D8 camlock	£125.00
Old 3 Jaw Chuck suitable for Dividing Heads, Fixtures etc. 1 set of Jaws only 4", 5" or 6"	£25.00
7" Crawford Trugrip Collet Chuck c/w 30 collets 3/16"-2" cap	£500.00
Herbert No.4 Quick Change Drill Chuck & Holders	£100.00
Jacobs 1A 0-1/4" Drill Chuck, 1JT Mount, Boxed, unused	£12.00
Jacobs 30 0-5/16" Drill Chuck, 2JT Mount, Boxed, Unused	£12.00
Jacobs 32 0-3/8" Drill Chuck, 2JT Mount, Boxed, Unused	£12.00
Hardinge Turrett Tool Presetting Fixture	£650.00
Aciera F4 Horizontal Overarm	£200.00
Aciera F4 Differential Indexing Gearbox & Gears	£450.00
Thiel 1/2" x 8" Horizontal Milling Arbor 3MT (unused)	£65.00
Thiel 5/8" x 8" Horizontal Milling Arbor 3MT (unused)	£70.00
Thiel 3/4" x 10" Horizontal Milling Arbor 3MT (unused)	£75.00
Thiel 3/4" x 8" Horizontal Milling Arbor, Thiel Taper (Unused)	£85.00
Thiel Collets (11 Assorted) Large Thiel Taper	£200.00
Thiel Stub Arbor 1/2" or 5/8" (unused)	£35.00
Thiel Collets (small) Various sizes	Each £15.00
Smart and Brown Step and Ring Collets(Models A & M).	Each £25.00
Disc Chucks for Boley Lathe, 15mm Dia. Shank	Each £25.00
Schaublin 102 Screwcutting Attachment (unused)	£750.00
8 x Schaublin F16 Collets	£75.00
8 x Schaublin F20 Collets	£85.00
6 x Schaublin F22 Collets	£75.00
Schaublin W20, W25 Collets	Each £10.00, £12.00
Pultra 8mm Collets	3 for £25 Each £10.00
Pultra 8mm Disc Collets	Each £15.00
Pultra 10mm Collets	Each £15.00
Pultra Vertical Slide	£160.00
5C Disc Collets (various diameters)	Each £15.00
1MT, 2MT, or 3MT tailstock die holder (new)	£30.00
3 MT horizontal milling arbor (new)	£75.00
3-2 MT open ended ejecting adaptor (new)	£15.00
3 MT stub arbor (new)	£30.00
40INT Stub Arbor (1.1/2" dia), unused	£35.00
3-4MT Extension Sleeve	£25.00
4-6MT Extension Sleeve	£50.00
Jones & Shipman 6MT Rotating Tube Centre	£100.00
1MT, 2MT or 3MT revolving centre (new)	£20.00
Mandrin Universal Floating Reamer Holder, 4MT Shank, 2MT socket	£85.00
4MT lathe centre (unused)	£8.00
5MT lathe centre (unused)	£10.00
6MT Fixed Centre (Unused)	£25.00
Viceroy 5" Catchplate	£15.00
Viceroy Change Gears, Various sizes available	£POA
Viceroy Topslide	£65.00
Raglan Gears, 32T-£10, 36T-£10, 42T-£12, 44T-£12, 45T-£12, 48T-£12, 52T-£14, 60T-£14	
Raglan 6" 4 Jaw Chuck	£100.00
Raglan Lever Operated Cut off Slide	£150.00
Raglan 6" Backplate	£22.00
Southbend Tailstock	£75.00
Dividing Head Tailstocks, 5" & 7" available	Each £30.00
Tailstock for Marlco Indexing Fixture 5" C/H	£150.00
J & S Type 2341 104 Double Ended Boring Bar	£15.00
Lushington LBK-161 3/8"-1" Cap. Capstan Knurling Tool 1.1/2" Shank	£150.00
Miller Type STRO, 1" Shank Quick Knurl	£125.00
Miller Type STR1, 2 MT Shank Quick Knurl	£125.00
Two Wheel Clamp Type knurling Tool (Marlco Type) NEW	£45.00
Tripan Size 111 Quick Change Toolpost and 6 Holders	£200.00
Burnerd TP2 Patent Toolpost set	£125.00
Deckel 40INT Horizontal Arbor	£75.00
R8 Horizontal Arbor, 1"	£60.00
Quantity of 2" Arbor Spacers	£30.00
Taylor Hobson Engraver Type Tables	Each £65.00
Qty. of Tooling for Ward Tool & Cutter Grinder	£350.00
Copies of Machine Manuals, Many Available	S A E For List

WORKSHOP EQUIPMENT

Omega 12 Ton Bench Garage Type Press, as new	£250.00
3' x 2' Surface Table	£250.00
12" x 8" or 10" x 8" Surface Plate	£40.00
12" x 12" Surface Plate	£45.00
18" x 18" Surface Plate	£65.00
Crown Windley 9" x 7" Black Granite Surface Plate, VGC	£75.00
Crown Composine 8" x 12" T-slotted Compound Sine Table	£325.00
Jones and Shipman 12" x 12" Co-ordinate Table, VGC	£300.00
P.V.E. No.2 Co-ordinate Table 12" x 13"	£350.00
5" x 5 1/4" Micrometer Adjustable Co-Ordinate Table	£150.00
Pair Windley Bros 15" x 18" x 24" Hand Scraped box Cubes	£300.00
9" x 7" x 6" T-slotted Box Cube	£65.00
12" x 10" x 9" T-slotted Box Cube	£75.00
12" x 12" x 24" Cast Iron Webbed Angle Plate, Hand Scraped	£150.00
Windley 6" x 6" x 6" Webbed Angle Plate	£45.00
6" x 5" x 4.1/2" Angle Plate	£25.00
20" x 15" x 15" Swivel Angle Plate	£150.00
10.1/2" x 10.1/2" T-slotted cast iron plate with handles	£40.00
M&W Metric Radius Gauge(New)	£7.00
Presto BSW Rethreading files (New)	£5.00
Number Drill Gauges 1-60	£5.00
General 255M Screw Pitch Gauge 9-40TPI	£7.00
Craftsman 9-4030 Screw Pitch Gauge 4-84TPI	£10.00
M&W Metric Wire Gauge, New	£6.00
Eclipse Junior Hacksaw Blades (Box of 100)	£8.00
17 off Eclipse 21" Machine Hacksaw Blades, 6TPI	LOT £75.00
Essex Tool & Gauge Co. 10" Sine Bar	£30.00
Matrix 250mm Sine Bar	£40.00
Mercer type 95011-451 Clock Stand	£35.00
Mitutoyo 3046E Metric Dial Gauge	£30.00
Essex 4" x 20" Sine Bench Centres	£300.00
J & S 4" x 24" Bench Centres	£200.00
22" X 8" Sine table	£150.00
Polish 10" x 1.1/4" Sine Bar (Boxed, Unused)	£40.00
CEJ 4" Sine Bar	£30.00
Smiths Tachometer max.rpm 20, 000, boxed	£75.00
Rabone 18" Engineers Spirit Level	£85.00
Watts 18" Block Level, 1 Div=0.0005" in 10"	£325.00
Hilger and Watts 12" B.S.S Type 2 Level, 1 Division=0.1mm/M	£200.00
Wyler (Swiss) 300mm Precision Level, 1 Div=0.0002"/10", As New	£275.00
Watts Precision 8" Square Block Level, 1 Div=0005"per 10", Cased	£225.00
Moore and Wright 402M 150mm Adjustable Square (Metric)	£75.00
M&W Spring Dividers 3", 4", 6"	£3.00, £4.00, £5.00
M&W Spring Calipers 3", 6"	£3.00, £5.00
M&W Spring Inside Calipers 3", 6"	£3.00, £5.00
Taylor Hobson 12.1/2" Television Projection Lens	£150.00
Windley Bros Tunnel Type Demagnetiser, 415 Volt	£150.00
Eclipse No 913 Pair of Magnetic Floaters	£25.00
Pair Eclipse No.823 Swivelling Brackets	£100.00
Pair 10" Vee Blocks	£75.00
Pair Toolmex Vee Blocks 90x70x125mm and Clamps, unused	£100.00
Pair Toolmex Vee Blocks 63x45x70mm and clamps, Unused	£65.00
Eclipse Minor 5" x 2 1/2" Magnetic Chuck, Box, VGC	£100.00
Fimax 10" x 6" Magnetic Chuck	£125.00
Walker Hagou 10" x 6" Magnetic Chuck, Immaculate, As New	£250.00
Eclipse 14" x 6" Magnetic Chuck	£150.00
Eclipse 18" x 6" Magnetic Chuck	£165.00
Eclipse 18" x 8" Magnetic Chuck	£175.00
PVE 8" x 2" & 2" x 2" Precision Rollers	Pair £25.00
Transwave 5HP Capacity Phase Converter (new)	£350.00
Transwave 3HP Capacity Phase Converter (new)	£280.00
Edwards Rotoburr Deburrer/Edge Beveller, Bench Mounted, 3ph	£200.00
Spare Circular Tables for imported Pillar/Bench Drills, from	£35.00
2MT Drill Quill for Imported Drill	£15.00
33" x 10" x 6" Ammunition Boxes	Each £5.00
Eclipse Type AX90 Circular 9" Magnetic Chuck	£100.00
Pair Eclipse No 925 Magnetic V Block Holders, vgc	£175.00
Eclipse Type No A818 Adaptor Plate, 14 1/2" x 6" x 1", Boxed	£100.00
Eclipse Type No A146 Adaptor Plate, 11" x 4 1/4" x 1", Boxed	£75.00
Eclipse Type DA Demagnetiser, 240v	£50.00
24" x 8" Magnetic Chuck	£175.00
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9 Jarno Taper Test Mandrel	£25.00
1 Morse Taper Test Mandrel	£30.00
Avery Type 6406 Hardness Tester	£350.00
Avery/Rockwell Hardness Test Block	£10.00
Large Quantity of Silversmiths, Tinsmiths Stakes etc	S A E For List
Blacksmiths Leg Vice on Tripod Stand	£75.000
Blacksmiths Leg Vice	£25.00
Blacksmiths Anvil and Stand	£150.00
Blacksmiths 12" x 12" Swage Block and Stand	£125.00
Bicksmiths 20" x 20" Swage Block and Stand	£175.00
Kasenit Gas Forge/Brazing Hearth	£200.00
Flamefast Small Tilting Type Casting Furnace, VGC	£250.00
Flamefast DS120F Combined Brazing Hearth and Forge, 3ph	£175.00
Flamefast DS100 Brazing Hearth	£150.00
Edwards Trufold 4' x 14g Box and Pan Folder	£1400.00
Edwards 6' Box and Pan Folder	£1500.00
Edwards 3' Straight Folder, Old	£200.00
Schechtl 5' Metal Guillotine, Hand Operated, Backgauge etc, VGC	£1000.00
Imetex Type GG2 Fine Sheet Metal Guillotine, Max 28swg x 9"	£250.00
Edwards 2T Flypress	£200.00
Hunton RA 12 Bench Punch Press	£150.00
Edwards 3' Treadle Guillotine	£250.00
Edwards 3' Bending Rolls	£500.00
Guyson Model DBH/40 Twin Arm Blast Cabinet and Dust Collector	£850.00
Tirfor T7 Winch c/w 10 m wire rope, test certificate, etc.VGC	£200.00
Parvalux Geared Right Angle Drive Motor 220/250 V, 1ph, output 454rpm, New, Unused, Boxed	£25.00
Fracmo 180 Volt DC Motor, 0.85 Amps, 3000 rpm, 1 ph, Boxed	£20.00
Avery Type 3205 ABF Platform Scales, 250 KG Capacity	£250.00
Avery Type 3205 CLE Platform Scales, 170 KG Capacity	£250.00
Prior Automatic Numbering Stamp (Fits in Fly Press)	£100.00
Electric Potters Wheel, 1phase	£250.00
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Three Marlco Broaches, 3/8", 1/2", 5/8"	£100.00
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M&W 3"-4", 4"-5", 5"-6" Micrometers	Each £25.00
M&W 6"-7", 7"-8", 8"-9" Micrometers	Each £30.00
M&W 9"-10" Mic	£35.00
M&W 10"-11" Mic	£40.00
M&W 11"-12" Mic	£45.00
M&W 15"-16" Mic	£60.00
M&W 17"-18" Mic	£65.00
M&W 18"-19" Mic	£65.00
M&W 19"-20" Mic	£70.00
M&W 21"-22" Mic	£80.00
M&W 22"-23" Mic	£85.00
M&W 23"-24" Mic	£90.00
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Mitutoyo 0-25mm Micrometer	£20.00
Brown & Sharpe Thread Micrometer, 8-13, 14-20, 22-30 TPI	Each £10.00
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Tesa 25 - 50mm Direct Reading Micrometer	£25.00
M&W 2"-6" Adjustable Micrometer	£65.00
M&W 0 -4" Adjustable Micrometer	£50.00
M&W 8"-12" Adjustable Micrometer	£100.00
Starrett 500-600mm Adjustable Micrometer	£200.00
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M&W 0-25mm Micrometer Head (Large dia. Thimble)	Each £25.00
Mitutoyo 103-927 0-75mm Micrometer Set, Boxed Unussed	£100.00
M&W 50-75mm Micrometer	£30.00
Etalon 75-100mm or 100-125mm Micrometer	£30.00
Starrett 225-250mm Micrometer	£45.00
M&W 250-275mm Micrometer	£50.00
Starrett 275-300mm Micrometer	£50.00
Starrett 250mm-275mm Mic	£45.00
M&W 275mm-300mm Mic	£50.00
M&W 200mm-300mm Adjustable Micrometer	£100.00
M&W 0-1" Micrometer 6" deep throat	£40.00
M&W 0-25mm Micrometer 6" deep throat	£40.00
M&W 75-100mm Micrometer 6" deep throat	£45.00
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Mitutoyo 0-25mm Hub Micrometer	£25.00
Mitutoyo 129/132 0-6" Depth Micrometer	£35.00
Mitutoyo 0 - 3" Depth Micrometer	£32.00
M&W 0-1" Depth Micrometer	£22.00
M&W 0-3" Depth Micrometer	£30.00
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M&W 8"-33" Internal Micrometer	£50.00
Starrett 50-200mm Internal Micrometer	£40.00
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M&W 50mm - 210mm Internal Micrometer	£45.00
M&W 200-570mm Internal Micrometer	£50.00
M&W 200-825mm Internal Micrometer	£60.00
Starrett 200-800mm Internal Micrometer	£65.00
Moore and Wright 2"-3" x 6" Throat Micrometer, boxed, vgc	£35.00
M&W Instrument Maker's Micrometer, boxed, vgc, revolving anvil	£100.00
Set of 7 CEJ Thread Micrometers, Whit.8-40 TPI	£125.00
Mitutoyo Digimatic Indicator No.575-203 1DU-1025E	£75.00
Mitutoyo 156-101 Micrometer Stand	£25.00
Browne and Sharp 4" Toolmakers Square	£40.00
Wallace Rubber Hardness Meter and Test Blocks	£50.00
Set of 9 Angle Gauges for Shadow Protractor Testing	£100.00
Acru 12" Master Square	£75.00
M&W No.400 4" Precision Square	£10.00
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Somet Bevel Protractor	£70.00
Somet Dial Gauge Metric 0-01mm (40mm dia)	£20.00
Somet Lever Type D61 Dial Test Indicator (metric)	£30.00
Metric Dial Gauge, Boxed	£15.00
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Matrix Gauge Block Accessory Set (VGC)	£150.00
M&W 9" Scribing Block	£20.00
M&W 18" Scribing Block	£25.00
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JFA Micrometer Adjustable Scribing Block, 500mm	£60.00
JFA Micrometer Adjustable Scribing Block, 900mm	£75.00
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18" D.T.I. Stand	£25.00
Verdict 12" Height Transfer Stand	£25.00
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Heavy Duty Dial Gauge Stand with Dial Gauge	£35.00
Matrix Level Comparator	£250.00
Sigma Comparator	£75.00
FWP Adjustable Comparator Stand with 0.0005 Comparator	£75.00
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Pratt & Whitney 48" Length Measuring Machine	£250.00
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Watts Microptic Measuring Machine	£150.00
Watts Angle Gauge Level	£100.00
Mahr No.24 Centri-meter	£150.00
Matrix Hob, Worm or Gear Profile Recorder, Boxed, Immaculate	£300.00
Mitutoyo DT10 Digimatic Data Transmitter c/w 8 off DL-10 Digimatic Data Loggers	£1000.00
Vickers M10 Microscope	£150.00
Tayloy Hobson Toolmakers Microscope, well equipped, choice of 3	£500-£750
Nikon Binocular Microscope	£150.00
C. Baker Microscope	£100.00
Union Metallurgical Microscope, box, light, VGC	£250.00
Hauser P219 Profile Measuring Microscope	£350.00
Hilger & Watts Type TA121-1-194771 Angle Decker, VGC	£400.00
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PVE E41 Workshop Slips	£50.00
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Mitutoyo 32 Piece Metric Slip Gauge Set, Excellent	£200.00
Mitutoyo 516-806 Pair Carbide Wear Slips 1mm Grade 0	£40.00
Mitutoyo 516/101N 10 Piece Metric Slip Set	£100.00
Mitutoyo 9 piece set 1-001-1-009mm	£75.00
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Chatillon 5Kg Spring Tension Gauge	£40.00
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Chesterman 1" x 2" x 10" Parallels (Boxed)	£65.00
Pair Windley 12" x 3" x 1.1/2" Parallels	£65.00
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Pair 25x50x250mm Parallels	£65.00
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Benson 12" Vernier Caliper	£35.00
Chesterman 12" Vernier Caliper	£35.00
Etalon 12" Vernier Caliper	£40.00
Starrett 24" Vernier Caliper	£50.00
Mitutoyo 1.5m Stainless Steel Vernier Caliper, boxed, VGC	£850.00
M&W 8" Depth Vernier	£35.00
Brown & Sharp 5" Vernier Depth Gauge	£15.00
Keighley 6" Vernier Depth Gauge	£25.00
Starrett 12" Vernier depth gauge	£25.00
Benson 14" Vernier Depth Gauge	£35.00
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Somet 300mm Height Gauge	£100.00
Mitutoyo 520/155 12"/300mm Height Gauge, Boxed, Unused	£165.00
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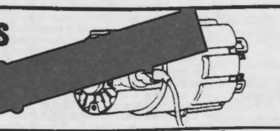

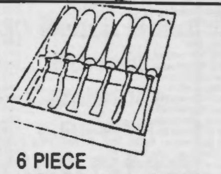

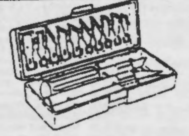

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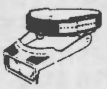

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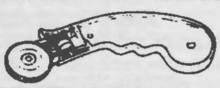

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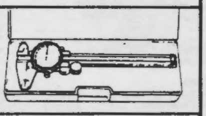

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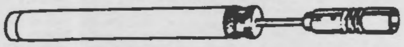

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The Midlands MODEL ENGINEERING EXHIBITION

18 – 25 OCTOBER 1997

at the

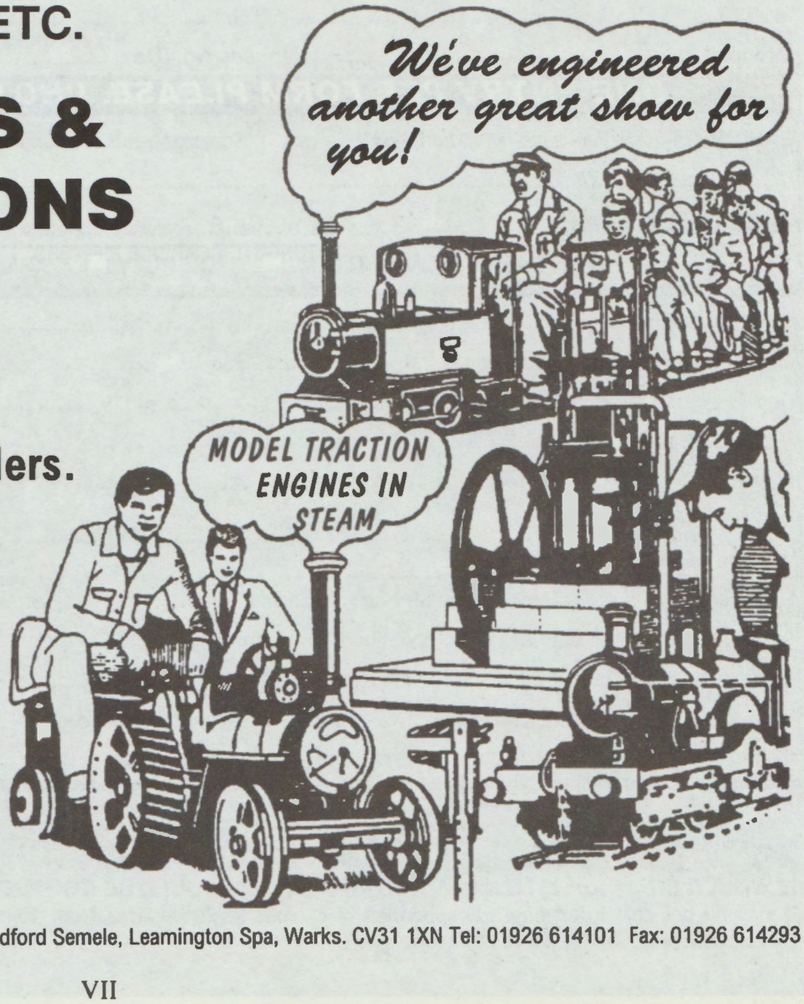
INTERNATIONAL EXHIBITION CENTRE

DONINGTON PARK, CASTLE DONINGTON, nr DERBY

SEE HUNDREDS OF SUPERB SCALE MODELS OF
RAILWAY LOCOMOTIVES, TRACTION
& STATIONARY ENGINES, ETC.

Daily LECTURES & DEMONSTRATIONS

& two live steam exhibition layouts from the Gauge 1 Model Railway Association & the Association of 16mm NG Modellers.


We've engineered another great show for you!
MODEL TRACTION ENGINES IN STEAM

OPEN 10.30 am - 6.00 pm DAILY
(Final day 5.00 pm)
Late night Thursday till 8.00 pm

Adults £7.00
Senior Citizens £5.50
Children £4.00
Family Ticket £18.00
(2 Adults, 2 Children)

2 DAY PASSES
ADVANCE BOOKINGS ONLY – NOT AVAILABLE ON THE DOOR
Adult £12.00
Senior Citizen £9.00

Exhibition organised by TEE Publishing, The Fosse, Fosse Way, Radford Semele, Leamington Spa, Warks. CV31 1XN Tel: 01926 614101 Fax: 01926 614293

Midlands MODEL ENGINEERING EXHIBITION

Entry Form

MODEL ENGINEERING 97

International Exhibition Centre, Castle Donington, near Derby

18th-25th October 1997

You are cordially invited to enter your model/s in our 1997 Midlands Model Engineering Exhibition to be held at the International Exhibition Centre, Castle Donington, near Derby. All exhibitors will receive a specially designed commemorative plaque and a diploma certifying that their model was exhibited at the exhibition. Whilst the exhibition is in progress all models will be fully insured and wherever possible all exhibits will be directly linked to wired alarm systems. Adequate barriers will protect all exhibits and night security will be maintained.

EXHIBITION CLASSES A total of sixteen classes exist as listed below. Furthermore, these are divided into two sections: **Competition** which will be judged by acknowledged experts and cups, etc. awarded and **Display** where exhibitors just wishing to display their work, finished or unfinished, may do so for the enjoyment of visitors.

Class 1	Locomotives – up to and including gauge 1	Class 9	Horological and Scientific
Class 2	Locomotives – 2½" and 3½" gauges	Class 10	Marine Models – Scale (over 50% scratch built)
Class 3	Locomotives – 5" & 7¼" gauge and above	Class 11	Marine Models – Kit (standard or modified)
Class 4	Rolling Stock, etc., any gauge	Class 12	Model Horse Drawn Vehicles
Class 5	Stationary Engines	Class 13	Scale Aircraft Models
Class 6	Steam Road Vehicles	Class 14	Young Engineers Award (under 20 yrs old)
Class 7	Machine Tools and Workshop Equipment	Class 15	Miscellaneous
Class 8	Petrol & Diesel IC Engines	Class 16	Hot Air Engines

IMPORTANT: THERE ARE NO COMPETITION ENTRY CHARGES AND CASH PRIZES ARE AWARDED WHERE APPLICABLE

ENTRY FORM: PLEASE COMPLETE ALL SECTIONS AND RETURN TO:

The Exhibition Manager, TEE Publishing, The Fosse, Fosse Way, Radford Semele, Leamington Spa, Warwickshire CV31 1XN.
Tel: 01926 614101 Fax: 01926 614293

COMPETITOR'S NAME ....

ADDRESS ....

....

Occupation .... Telephone No. (Day).................................. (Eve) ....

ONE ENTRY PER FORM PLEASE. PHOTOCOPIES ARE ACCEPTABLE

EXHIBIT (Please give detailed description): .... Scale/gauge* ....

....

....

PLEASE STATE WHETHER – COMPETITION ☐ DISPLAY ☐ *Please delete as required

CLASS
ENTERED ....

Origin of design ....

Overall size with base if applicable .... Weight .... Value ....

Details of workshop facilities used in construction ....

....

Details of any work on the exhibit not undertaken by you, or not of your own manufacture (excl. commercial castings, etc.) ....

....

Will you be delivering the model to:* Exhibition ☐ Leamington Spa office ☐

Has the model been entered in any other Exhibition .... If Yes, please state which ....

Any further information to assist compilation of the Exhibition Guide ....

....

Has a photograph been enclosed .... This is for publicity and may be used in the Exhibition Guide. Photographs will be returned after use.

If a member of a Model Engineering or other Society, please state which ....

---

* All exhibitors will receive an exhibitors pass (not transferable) and official receipt for their exhibit upon delivery either at the exhibition or at the office of TEE Publishing. Exhibits should be delivered to the exhibition from 2.00 pm until 8.00 pm on Friday 17th October 1997 or to our offices from Monday 13th October onwards by arrangement and can be collected from 5.30 pm until 8.00 pm on Saturday 25th October or from 8.00 am until 10.00 am on Sunday 27th October 1997. Receipts will be given to all owners and must be presented to claim your model at the end of the exhibition. The system for collection of models has been simplified to ensure models can be collected by their owners with the minimum of delay.

IT WOULD BE OF ASSISTANCE IF THIS ENTRY FORM COULD BE COMPLETED AND RETURNED BEFORE 22nd SEPTEMBER 1997

It may be possible to arrange transportation of exhibits for those who live a considerable distance from Castle Donington. Please contact the Exhibits Secretary for further information.

EDITORIAL

THE MIDLAND MODEL ENGINEERING EXHIBITION

Plans are well advanced for this year's Midlands Model Engineering Exhibition to be held at Castle Donington near Derby from the 18th to the 25th October. Even as we write, the exhibition is nearly fully booked in many respects and we have a good turnout of club stands as is usual. There have been a few changes in the floor plan and this year we will we hope see an even bigger display of steamboats at one end of the hall, whilst the 5" gauge ground level marshalling yard moves to the lower end of the hall to make use of the greater amount of space there. It is intended to enlarge the area occupied by the marshalling yard so that more realistic and intensive operating can take place. We also hope to considerably increase the workshop area, while a local technical college has been asked to present an evening class scenario alongside it.

We are looking forward to seeing the usual high standard and vast range of models, both on the club stands and in the competition entries, and entry forms for the competitions will be available from our office in the course of the next two weeks. If you are interested in entering your work in the exhibition, please do not hesitate to contact us.

We are hoping that as usual there will be quite a variation in the selection of models on display and there will be a very strong trade representation at the show with nearly all the UK's leading suppliers being present. The exhibition offers an excellent opportunity to stock up on materials, tools and machinery, and represents a complete and very satisfying day out for any model engineer. We look forward to seeing you there.

THE TERENCE CUNEO EXHIBITION

A collection of paintings and sketches by the late artist and railway enthusiast Terence Cuneo will go on public display at the Institute of Civil Engineers in London from 4-29 August 1997. 'The Terence Cuneo Summer Exhibition – A Journey of Engineering Discovery' will include, amongst others, 'The Flying Scotsman crossing the Forth Bridge', 'A Dawlish King', 'Castle on the Coast', 'The Royal Albert Bridge, Saltash' as well as some other paintings and drawings being shown for the first time ever.

The exhibition will focus on Cuneo's passion for railways and engineering, as well as his meticulous attention to detail in emphasising the engineering achievements which helped to create Britain's railways. The exhibition is being mounted as part of the Year of Engineering Success, which aims to increase understanding of the vital role engineering plays. It will be held at the Institute of Civil Engineers at their headquarters at 1 Great George Street, Westminster, London SW1 every weekday from 10.00am–4.30pm and admission is free. Terence Cuneo CVO OBE RGI (1907-1996) was the country's foremost commercial artist who not only recorded our railways and engineering history, but also great national and international events which included military battles and State occasions. This is an unique opportunity to see much of his railway related work together and an opportunity not to be missed.

MODEL ENGINEER'S DAY

The annual Model Engineer's Day held at the Forncett Industrial Steam Museum will take place this year on 2nd November. As usual the museum's full-size engines will be in steam throughout the day and exhibitors are encouraged to run their models on steam or air, with compressed air being available to all display tables for those who wish to use it. The museum is very keen to have as many entries as possible and, as well as completed engines, they would also like to see a good range of examples of work in progress. If anyone is interested in participating, entry forms and further details of the museum can be obtained by sending a large stamped addressed envelope to Mr R F Wilson, 6 Broadland Close, Worlingham, Beccles, Suffolk NR34 7AT.

The event will be open from 10.00am–6.00pm and, as we have said in the past, it is well worth making the effort to visit the museum in its own right, but with the added interest of the Model Engineer's Day, it is certainly a pilgrimage worth making!

7¼" GAUGE RALLY

Owners of 7¼" gauge models of standard gauge locomotives are invited to the Ascot Locomotive Society's rally at its ground level track in Ascot Racecourse No 10 Coach Park, Berkshire. This event will take place on 30th August and will be open from 10.00am to 6.00pm.

With its 1 in 60 gradients, the Ascot track provides an interesting challenge for loco drivers and there is much of interest for spectators, including a superb fully signalled station terminus operated by a 22 lever signal box. There is also a turntable, extensive steaming bays and many other features. For further details, please contact the society's secretary, Tony Alderman, telephone 01932 854393 or fax 01932 851420. As is customary, boiler certificates will be required.

NEW CLUB PROPOSED

An inaugural meeting of the new Midlands Model Steam Road Vehicle Club will take place at Digbeth In The Field Church Hall, Moat Lane, Yardley, Birmingham at 7.30pm on Thursday 7th August. It is proposed to hold an informal meeting with a view to gauging the interest in forming a society dedicated to model steam traction engines and road vehicles, etc. It is hoped that there will be sufficient interest to launch the new club to a flying start.

PRACTICAL MACHINING CLASSES

Readers may be interested to know that John Jones, our contributor who has just completed the excellent series 'Boilermaking the Fairly Easy Way', tutors practical machining classes at Brooklands College, Weybridge, Surrey. There is access to an extensive workshop and the classes are ideally suited to model engineers and also to those involved with mechanical renovation, such as vintage cars. Tuition is given to beginners and the college gives experienced machinists access to machines which they may not have in their home workshop. The classes are held every Monday evening from 6.00 to 10.00pm in ten-week sessions starting September. Further details can be obtained directly from John on 01483 233867.

The Royal Albert Bridge, Saltash *(1959) painted by Terence Cuneo for a commemorative poster to mark the centenery of Isambard Kingdom Brunel's bridge which links Devon and Cornwall.*

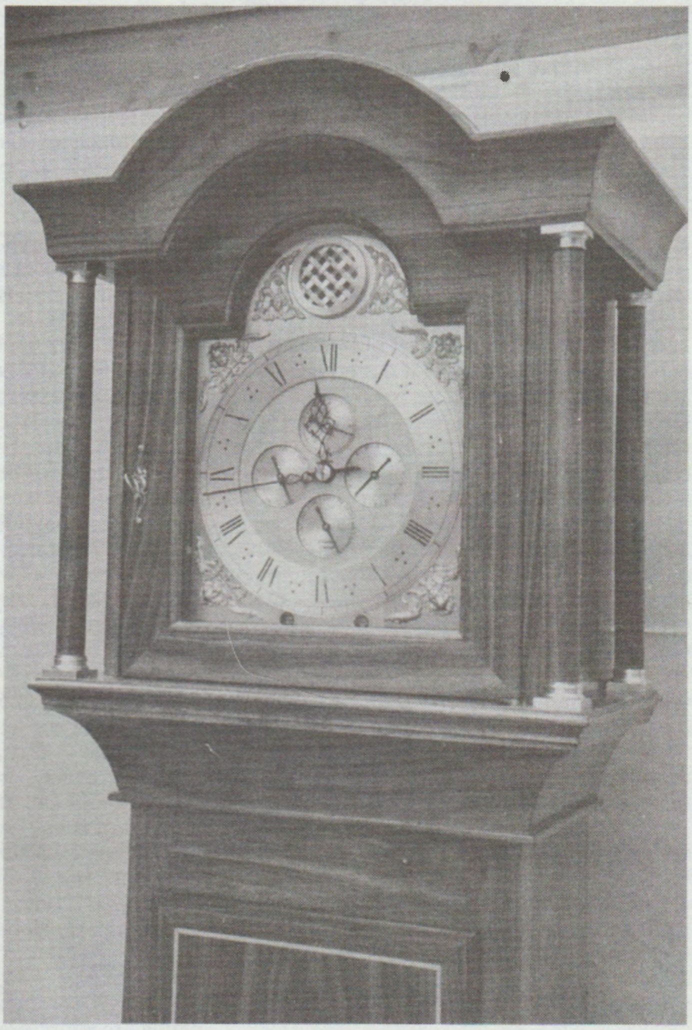
CONSTRUCTING A YEAR-GOING LONGCASE CLOCK

by F P Matravers

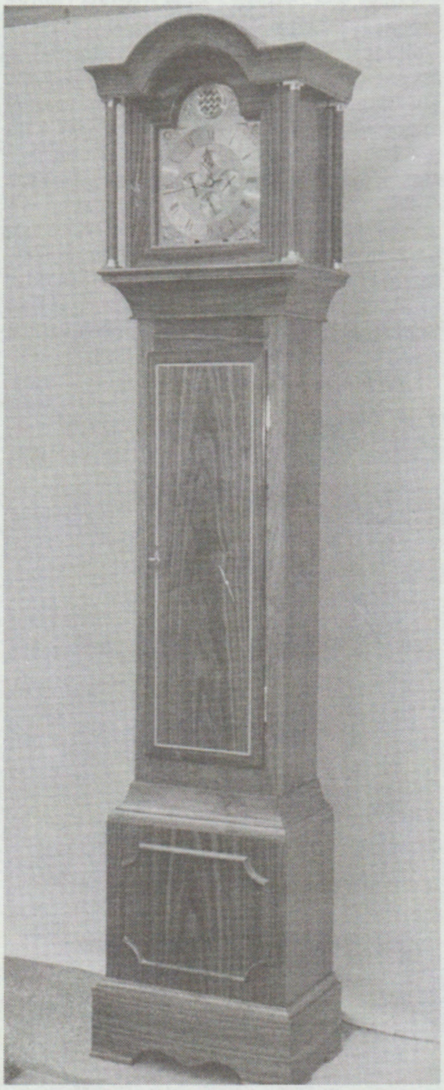
INTRODUCTION AND DESIGN CONSIDERATIONS

Some fifteen years ago I completed the construction of a three-train clock from the data given in Claude Reeve's book entitled *The Musical Clock.* This was my first venture into clockmaking and the fact that the clock continues to perform well is, I believe, a tribute to the author. The project took three and a half years of spare-time working, but this included the manufacture of various items of tooling, including a wheel-cutting engine, a set-up for milling pinions on my Myford Super 7 lathe, a depthing tool, a range of index plates, wheel and pinion cutters and numerous small items.

Subsequently, I made a number of clocks which were less challenging than my initial effort, but I harboured an ambition to build a year-going long-case clock – possibly as a project for my forthcoming retirement. I was aware that such clocks had been made, but they were housed in cases which would be too tall for a modern house. Britten's *Watch and Clockmaker's Handbook* was, to say the least, discouraging in saying that even six-month clocks were not to be recommended because of the enormous friction generated within the extended gear-train.



Right: Close-up of the dial and the hood – the four auxiliary dials show, clockwise from the top, seconds, date, month and day of the week.



Left: View of the completed clock. Its overall height is 82".

I had put the project to the back of my mind when I saw Claude Reeve's articles on 'Constructing a Year Going Clock', which was first published in 1951 and reprinted in the fourth and fifth editions of *The Clockmaker*.

I was immediately struck by the schedule of gearing (see table 1), in which all the driven pinions had twelve leaves. Even with my limited experience, I was aware that this relatively large number of leaves would greatly ease the task of minimising the entering and leaving friction of the mating gear-teeth (this particular subject is covered very satisfactorily in the chapter on gearing in Mr Donald de Carle's book, *Practical Clock Repairing*, available from TEE Publishing). In fact, I would recommend that anyone contemplating the building of a clock, but lacking previous experience, should read this book carefully beforehand since it deals with many of the essential aspects of the clockmaker's craft.

I calculated that the overall gear ratio from great-wheel to 'scape-wheel would be 1:47,040 (see table 2) compared with an eight-day longcase movement having an overall ratio of 1:720. Britten contends that for similar drops, the driving weight would have to be increased pro-rata with duration, which would result in a weight of around 525 lb (taking a typical eight-day longcase weight to be 8 lb). Clearly this would be untenable and, to avoid the use of such an excessively large weight, it would be necessary to produce a movement that would make more efficient use of the available power.

Because the action of an escapement is such that the train is alternately stopped and released, the drive must be capable of overcoming the inertia of the movement in order to restart it after each half-cycle of oscillation of the pendulum. The mass of the moving parts is therefore a critical factor. Furthermore, after coping with energy losses in the friction of bearings, gears etc, sufficient power must be delivered to the 'scape wheel to maintain the operation of the pendulum. It was therefore apparent that the mass of the gear train would need to be kept as low as possible but commensurate at the driven end with the substantial driving weight which would undoubtedly be required.

It appeared that Mr Reeve had considered this and had effectively divided the movement into two with a substantial 'power unit' at the bottom containing the barrel arbors and three stages of gearing. His use of two barrel arbors with great wheels driving a common pinion halved the size of the individual driving weights and similarly reduced the loading upon components such as the barrel ratchet click and the leaves of the second wheel-pinion.

The third and final stage of this lower unit carried a wheel equivalent to the great wheel of an eight-day clock (see Table 1). This drove an upper movement which was more or less conventional, but which was much lighter than that of a normal eight-day longcase clock. Diametral pitches of 52 and 72, allied to wheels 'skeletonised' to produce five light spokes, resulted in a train with very low mass, more akin to a small mantel clock than to a longcase clock.

Concerning the important question of the weights necessary to drive the movement, Mr Reeve's article did not make this clear, to me at least. However, I took it to mean that to 'get way on the wheelwork' a total weight of seventy pounds was hung on two short lines, one to each of the barrels – that is, a thirty-five pound pull on each barrel. The eventual use of single-sheave weight pulleys, to reduce the drop to that which could be accommodated within a case of less than seven feet overall, would thus entail two weights each of seventy pounds. This conclusion, however, does not tally with Mr Reeve having specified a casing for the three inch diameter and fifteen inch long weights which, if filled with lead, would only weigh about forty pounds. At this stage it was only possible for me to assume that a very considerable weight would be necessary and to accept that this could only be determined experimentally once the movement was built.

For the plates of the movement, I intended to use some brass sheet that I had by me which was three millimetres thick, but even so this would require reinforcing to provide sufficient bearing area for the heavily loaded barrel arbors. I therefore decided to use sealed ball bearings for the arbors for the weight pulleys (the bearings of which would carry twice the loading of the barrel arbors) and for the arbor of the common pinion (elsewhere called the second wheel arbor). Realising that sealed ball bearings have slightly more drag than non-sealed ones, I considered that the exclusion of dust outweighed this disadvantage, especially so early in the gear train.

I could see no point in taking ball bearings any further up the movement where the loadings would be lighter, as they would offer no advantages over plain pivots and indeed would add to the moving masses. Therefore the remaining arbors would comprise plain, hardened and polished pivots finishing in points at their ends. End thrust would be taken at one end by a dead hard steel plate acting as an 'end stone', whilst a similar duty would be performed at the other end by the flat bottom of a hardened steel screw, the screw enabling shake to be adjusted to fine limits.

TABLE 1
SCHEDULE OF WHEEL AND PINION DATA
Dimensions in inches

Ref.	Tooth Count	D.P.	P.C.D.	Full Dia.	Thickness	Pinion Bottom Diameter	Pinion Tooth Thickness	Description
1	112	34	3.294	3.374	5/16			Great Wheel (2)
2	12	34	0.353	0.390		0.235	0.037	2nd Wheel Pinion
3	112	40	2.800	2.868	3/16			2nd Wheel
4	12	40	0.300	0.331		0.200	0.032	Lower 3rd Wheel Pinion
5	108	52	2.077	2.129	1/16			Lower 3rd Wheel
6	12	52	0.231	0.255		0.154	0.024	Centre Wheel Pinion
7	96	72	1.333	1.371	3/64			Centre Wheel
8	12	72	0.167	0.184		0.110	0.017	Upper 3rd Wheel Pinion
9	90	72	1.250	1.28	3/64			Upper 3rd Wheel
10	12	72	0.167	0.184		0.110	0.017	Escape Wheel Pinion
11	30	n.a.		1.125				Escape Wheel
12	44	56	0.786	0.835	1/16			Minute Wheel
13	44	56	0.786	0.835	1/16			Reverse Minute Wheel
14	6	50	0.120	0.158		0.048	0.025	Reverse Minute Wheel Pinion
15	72	50	1.440	1.494	1/16			Hour Wheel
16	144	50	2.880	2.934	1/16			24 Hour Wheel
17	78	40	1.950	2.000	1/4			Barrel Winding Wheel
18	36	40	0.900	0.950	1/4			Intermed. Winding Wheel
19	36	40	0.900	0.950	1/4			Winding Wheel

I have read that with conventional pivots, up to 60 percent of the frictional losses occur at the shoulders where these bear on the inside of the plates. With the arrangement I have described, friction due to end thrust occurs at nominally zero radius where its effect will thus approach zero. A further advantage is that the shoulders of the arbor can be radiused, reducing stress concentrations at these points. Regrettably, I cannot claim to have originated this idea as I first saw it used in a regulator that passed through my hands some years ago.

To reduce winding effort and to bring the winding holes clear of the chapter ring, reduction gears connect the barrel arbors to the winding squares. I considered an arrangement whereby these gears could be taken out of mesh once winding was complete, the idea being further to reduce inertia and frictional losses. I concluded, however, that this would be an additional complication yielding little benefit, since in normal operation these gears would run unloaded.

TABLE 2
GEAR RATIOS

Arbor	Tooth Counts	Ratios Stage	Ratios Cumulative	Revolutions Per Hour	Revolutions Per Day	Revolutions Per Year
Escape Wheel		1:1	1:1	50	1,440	525,600
Upper 3rd Wheel	90/12	7.5:1	7.5:1	8	192	70,080
Centre Wheel	96/12	8.0:1	60:1	1	24	8,760
Lower 3rd Wheel	108/12	9.0:1	540:1	0.111	2.666	973.3333
2nd Wheel	112/12	9.333:1	5,040:1	0.0119	0.2857	104.2857
Great Wheels	112/12	9.333:1	47,040:1	0.001275	0.0306	11.1735

I decided not to incorporate maintaining power, since the interposition of a maintaining ratchet wheel between the barrel ratchet and the great wheel could compromise the strength of the winding click assembly, whilst being of little benefit for a clock which would be wound only once a year. This decision was later reinforced, since in use one weight proved sufficient to keep the clock going for the time necessary to wind up the other.

Considering the escapement, a recoil type would be unsuitable since the pendulum, being obliged to push the train backward at each end of its stroke, would thereby be giving up some of its kinetic energy. Presumably this was the reason why a deadbeat type was specified in the original article. Nevertheless, I was not too impressed with Mr Reeve's provision for adjusting the beat of the pendulum.

Anticipating that the beat would have to be capable of very fine adjustment because of the low power available at the 'scape wheel, I decided instead to incorporate the arrangement used in his musical clock. As the adjusting screw would then be at the top end of the crutch, advantages would lie in its accessibility and the ability to make adjustments without stopping the pendulum.

Throughout the construction of the clock, I have adhered generally to Imperial measurements to be in keeping with a clock that will follow traditional English clockmaking practice in using the DP system for dimensioning the gearing. The few exceptions are due to material availability such as ball bearings which nowadays are usually stocked in metric sizes.

Detailed drawings and text dealing with the various stages in making the clock will appear in subsequent chapters.

To be continued.

Robert Morrison's 1865

THREE TON DOUBLE ACTING STEAM HAMMER

in $^1/_2$" scale

David Piddington

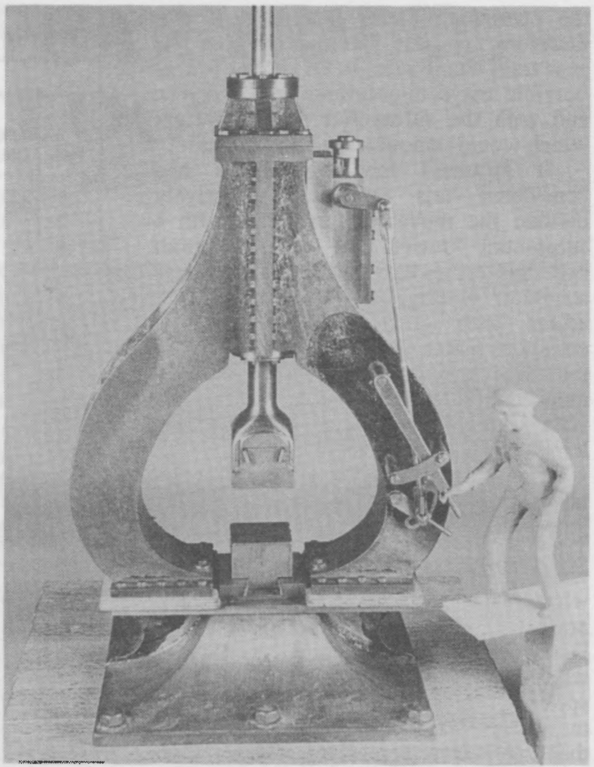
Introduction

Robert Morrison was a mid-Victorian engineer credited with a number of improvements to the steam hammer originally 'invented' by James Nasmyth, though in fact this was an application of steam to the water wheel driven tilt hammer. The description of Morrison's three-ton hammer is taken from the *Practical Mechanic's Journal*, Volume 9 second series, April 1864 to March 1865. On the header page are some poignant quotations – one from Charles Babbage (the 'father' of the computer) states that 'the successful construction of all machinery depends on the perfection of the tools employed; and whoever is a master in the art of tool-making possesses the key to the construction of all machines; . . . the contrivance and construction of tools, must, therefore, ever stand at the head of the industrial arts.'

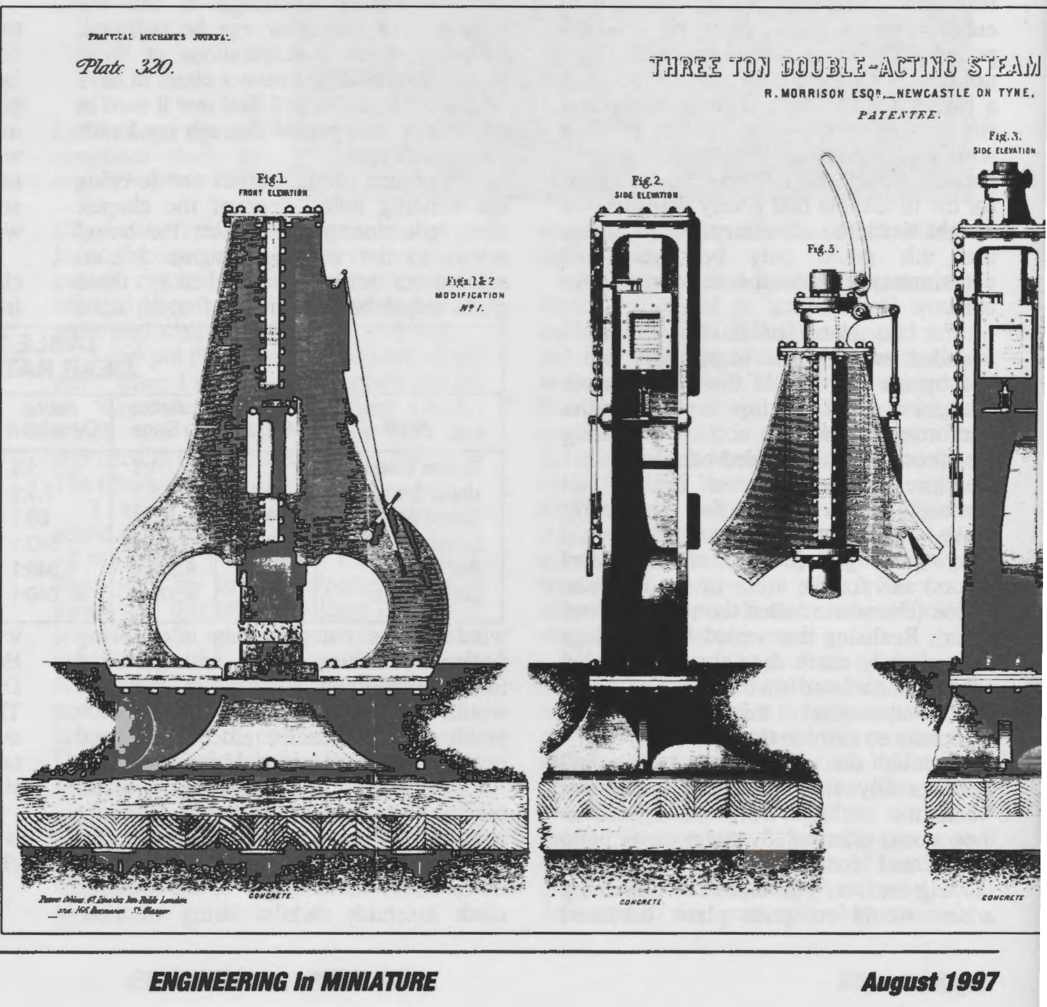
In January 1865 there appeared some magnificent plate engravings of Mr Morrison's latest hammers and I have included photocopies of them opposite. These engravings were accompanied by a considerable description of these machines and a résumé of his earlier works and, as the originals are probably difficult to locate and read, I propose to repeat some of them here in the elegant language of our forefathers thirteen and a half decades ago:

'. . . of the valuable improvements which Mr Robert Morrison, of the Ouseburn Engineering Works, has from time to time introduced into the steam hammer; and we now have pleasure in bringing to the notice of our readers the most recent of Mr Morrison's well-digested arrangements of this invaluable aid to the engineer. Before referring to the improved steam hammers, which form the subject of our plate engravings this month, a passing glance at this gentleman's earlier efforts towards the increasing the efficiency and simplification of the steam hammer will not be out of place.

'In Mr Morrison's first hammer (engravings of earlier machines appeared in earlier volumes of the Journal) one of the main features consisted in forging or casting the piston and slides on one solid hammer bar, which worked through stuffing boxes in both ends of the cylinder. He subsequently brought out a hammer constructed on the same principle, but provided with a link for working the valve, the link being actuated by anti-friction roller on the top end of the hammer bar. We next find a hammer with over-hanging frame and cylinder fitted with improved valves, the general arrangement affording greater facilities for working it on the usual model. This was shortly followed by another hammer of similar characteristics, suited for heavy work, which was succeeded by his monster fifteen ton hammer. Figs. 1 and 2 on the engravings, illustrate, respectively, a side and end elevation of a three ton double-acting steam hammer, specially arranged for shingling (squeezing), and parts 3 and 4 represent similar views of a three ton double-acting steam hammer arranged for shingling or forging and fig 5 is a self-



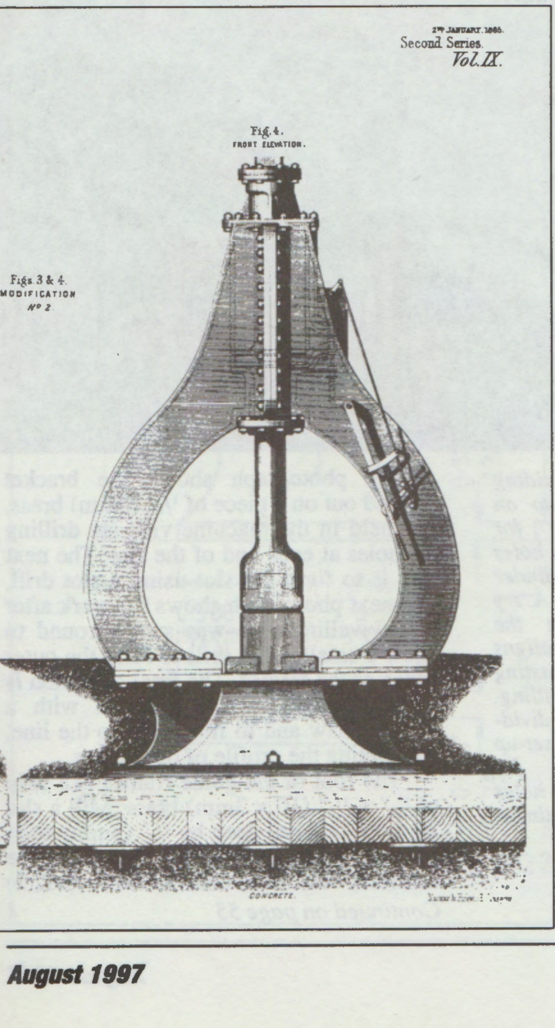
A scale figure stands beside the model of Robert Morrison's three-ton double-acting steam hammer.



acting variable gear adapted for either hammer.

'According to Mr Morrison's present improvements he dispenses with the usual arrangement of fixing steam hammers upon a foundation plate separate from the anvil block, and in lieu thereof, bolts the base of the hammer frames of legs, to brackets cast upon, or bolted to, or secured in any other way, to the sides of the anvil block. The base of the anvil block is extended to such an extent as will sufficiently steady the whole machine without further foundations. A thickness of hard wood is interposed between the frames and the flanges of the block in order to relieve the bolts from any jar caused by the action of the hammer.

'It is a well-known fact, that the heavier is the anvil block for a hammer, the more steadily and efficiently it will work; and the whole weight of the hammer, in this case, resting upon the anvil block, and firmly secured to it, will render nearly double the weight or inertia of the anvil block, and thereby rendering it more capable of withstanding the force of impact. The cylinders are made in two pieces, and bolted together, each half being made in one piece with one of the frames or legs, or it may be bolted to them. By making the cylinder in two pieces, the piston, piston rod, and hammer head, may be constructed so as to receive the face in one solid mass, without the necessity of having separate covers and stuffing boxes in two halves, as at present, which causes a great deal of care and trouble. The cylinder bottom and stuffing box are cast in one piece with the cylinder and frames, (the gland only being in two pieces), they are well bolted together with steam-tight flanges, and, in fact, form the whole casting of the hammer proper. Beneath the cylinder the inside faces of the frames are formed into guides to receive the hammer-head, and at present, when the hammer is fitted together, a hollow square, in which the hammer-head works up and down, not only prevents the hammer-bar from turning, but guides the hammer head close down upon its work. The lower parts of these guides meet, and are firmly bolted together with strong flanges and bolts, as already described, experience having shown that at this point the greatest tendency to twist the bar and strain the hammer occurs. Having served the purpose of guides, the frames recede from each other, so as to admit the anvil block between them, and give room for working the balls, and afford a wide base for the hammer to rest upon. This class of hammers is intended specially for puddling or shingling iron or steel; and as there is not so much room required as when forging, and the blows are more severe and irregular, the frames are brought down near to the anvil block, and the hammer head is guided between the frames solidly down close to its work, in guides with large wearing surfaces, as described above. The frames are bolted together at the bottom of the guides, so that the whole is made very compact and firm whilst the hammer-head is well guided down upon its work. For forging purposes the cylinder may be made in two pieces, or bolted to the frame in the usual way; and by this new arrangement the advantage of a solid blow will be secured whilst the frames are firmly held in their place at the base by the anvil blocks, as already described.



'It will thus be seen that the chief aim of this new arrangement of hammer is, to do away with the inconvenience and insecurity of a separate foundation of masonry, and independent anvil block.

'In the previous method of fixing forge hammers, it was customary to bed the anvil block on a platform of timber. On each side of this block two pillars of masonry were built, on which were bedded the foundation plates, the whole being tied by long bolts passing through so as to form a foundation for the hammer. The anvil block was made as large and massive as possible, but even then, the continuous force of the blows acted on the block as on a pile, and in a time, varying with the nature of the soil underneath, the anvil was found to sink, thereby endangering the hammer itself. The percussive action also extended itself to the masonry; and no structure, however well built, could be guaranteed to withstand this injurious jarring.

'While not making the block of itself any more unwieldy or uselessly massive, advantage has been taken of bringing the whole weight of the machine itself, with foundation plates, to augment the weight of the anvil, and thus a greater *vis inertiæ* is secured than could be gained by any ordinary anvil block; and the whole machine bound within itself will be found not only to combine the advantages of stability, with additional forging efficiency, but also doing away with the inconvenience of piling and securing the sub-soil, waiting for building and settling of masonry, finding foundation bolts, supplying and levelling bed plate and anvil block, and making and fitting bottom face, all which have at present to be done by the purchaser, before he can erect and work the hammer.

'The cylinder, one half of which is cast with each frame, is firmly bolted together, enclosing the piston on the hammer bar; the bottom and stuffing box is thus obtained in one piece with the main casting, the packing being kept good, in the usual way, by a gland, in halves. Under the cylinder the frames are formed into guides for the hammer-head to work in, and present, in section, a hollow square, so as to obviate any likelihood of the bar turning round. These frames are continued to guide the hammer-head close down upon its work, the lower part being strongly bolted together, it being here that the greatest tendency to twist the bar and strain the hammer arise.

'The bar is of wrought iron, with the piston and head for the reception of hammer-face forged solid with it, according to the practice of this firm, the face, of cast iron, being secured by a dovetail and key. Any form of head required by the nature of the work can be adopted to this bar. The anvil block and the foundation plates are cast in one piece, two massive wings being cast with the block, and strongly bracketed to it, upon which the hammer rests, a thin layer of wood being interposed to lessen the jar – the bottom of the anvil block being extended to a large square sale, so as to give stability to the whole machine. Nothing further being required than a layer of timber upon a bed of concrete to rest it on. The valve is equilibrium, double action, and is so arranged as to bring the levers within reach of the attendant on the ground, when worked by hand, when self acting. By the above improvement the saving in the cost of each steam hammer, with anvil, block, and bed plate, will be about 20 percent, and in the foundation about 50 percent, whilst the maker will be enabled to deliver: the hammer complete and ready for use.'

Note: The previous articles regarding Morrison's work in that publication may be found as follows:

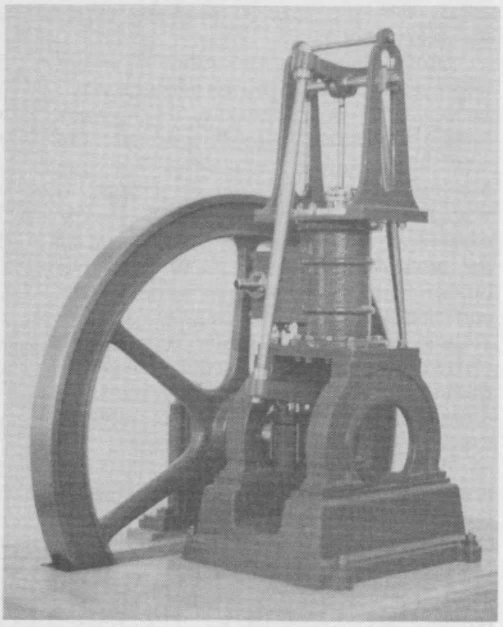
Plate 155, page 97, Vol. VII. (first series)
Plate 254, page 239, Vol. V. (second series)
Plate 265, page 270, Vol. V. (second series)
Plate 266, page 294, Vol. V. (second series)
Plate 227, page 132, Vol. VI. (second series)

I would suggest it worthwhile researching these further in a reference library, for copies of this particular magazine seem to be very rare indeed. However, for the purposes of describing the construction of a working model of the forging hammer which follows, I did not feel that further research into the history of the Morrison works would benefit us greatly.

To be continued.

REULEAUX'S TRAPEZIUM CONNECTING ROD ENGINE

Model designed and described by Anthony Mount



Part Two

The table can either be machined from a gunmetal casting or alternatively machined from mild steel plate. Whatever material is selected, mill all round the edges to bring the blank to overall size. Hold the work in the four-jaw independent chuck and machine the boss. Reverse and bore out the recess, the boss being held in soft jaws which have been bored out to receive it. Follow this operation by transferring to the dividing head and drill the cylinder stud holes. Set the table to the right orientation by using a try square off the lathe bed against one of the straight sides. Remove from the lathe and mark out the four holes in the corners, which are to be drilled 2.6mm.

The gunmetal casting for the steam-chest can be held in the machine vice for milling all over using end mills. An alternative is to use the four-jaw independent chuck on the lathe and to face all the outside edges in the lathe. You will however need to use the lathe to form the steam inlet boss.

While in the lathe, the valve rod gland boss can be drilled reamed and counterbored. It is a pity about the elliptical boss – this will have to be hand filed, though as seen in the photograph opposite, it can be partly formed by milling away the bulk of the material. It is tempting to make the boss circular and to fit three studs, something that was done on some full size engines. Indeed some had round bosses and two studs.

Using co-ordinates, drill the stud holes or use co-ordinates once for drilling the steamchest cover and use this as a template to drill the holes in both the steam-chest and cylinder. Drill for the steam entry and drill and tap the remaining stud holes in the valve gland and entry boss.

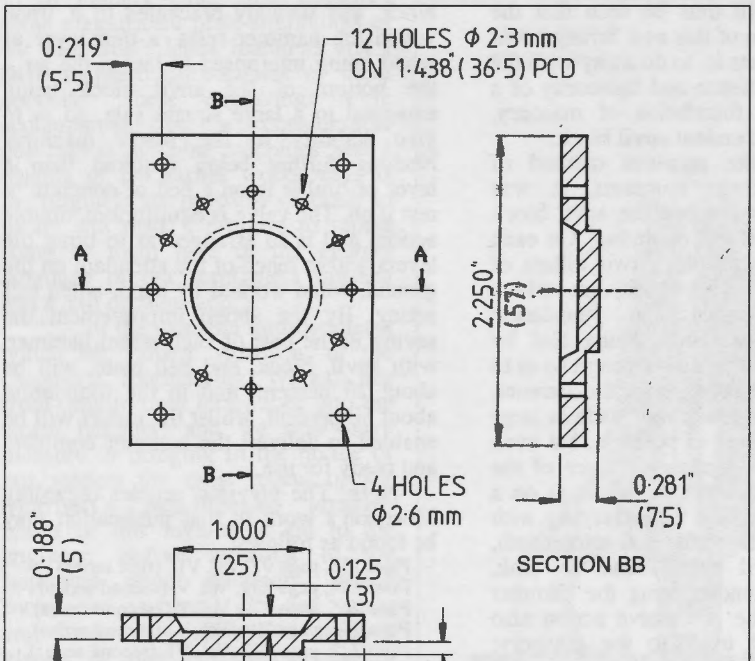
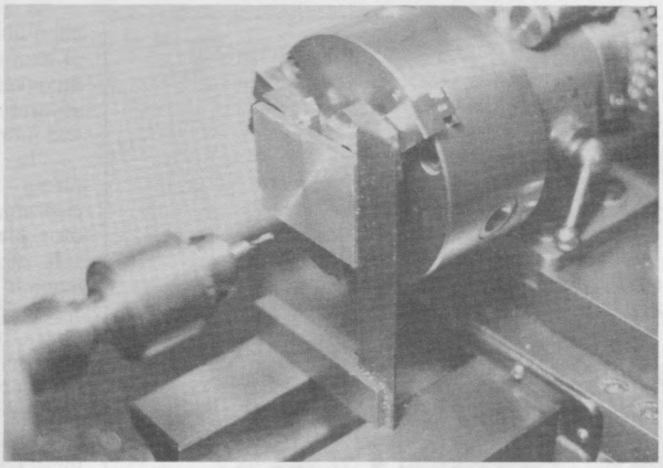


TABLE
1 off Gunmetal

The guide frames are a most attractive shape, but they do present some problems with holding. In full size they would have been castings, but as they are quite slim I opted for a fabricated design. I also kept things simple by using flat surfaces. As a casting the rubbing surfaces guiding the guide blocks would have been raised above the general surface and the external rim would also have been raised. You could achieve this by milling a depression about 10 thou (0.25mm) deep on both surfaces leaving a $^1/_{16}$" (1.5mm) band around both the central slot and the perimeter. As you can see from the shape of the guide brackets this is going to be an awful lot of work.

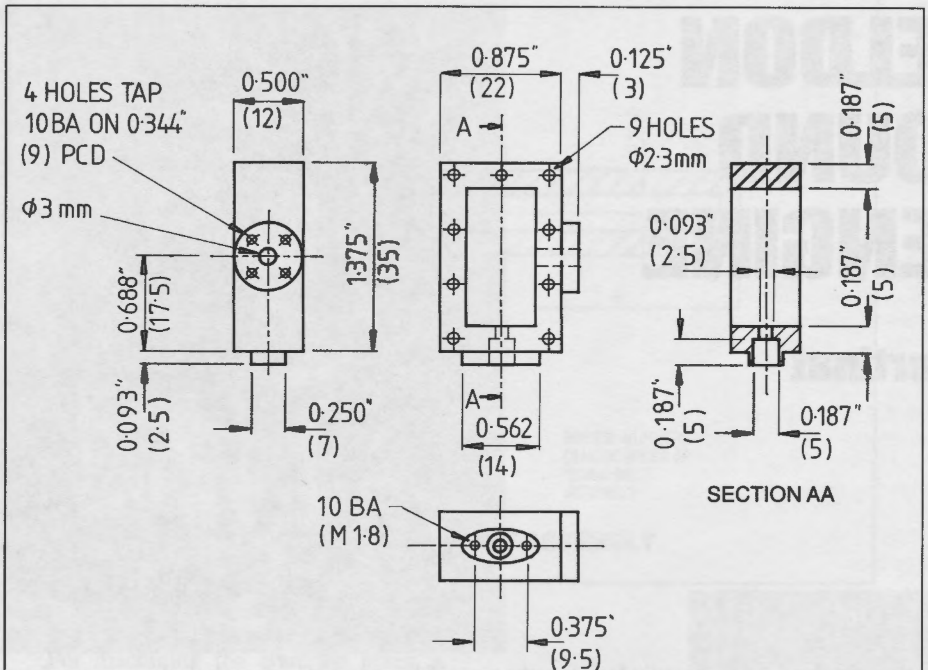


The dividing head set up on the table for drilling the holes for the cylinder mounting. A try square on the lathe bed aligns the table casting prior to drilling. The same dividing head set-up is used for drilling the holes in the cylinder top cover.

My photograph shows the bracket marked out on a piece of $^1/_8$" (3mm) brass, and held in the machine vice for drilling the holes at each end of the slot. The next step is to form the slot using a slot drill. The next photograph shows the work after the swivelling vice was swung round to allow a smaller slot drill to form the outer edges of the frames. The final operation is to saw off the waste material with a piercing saw and to file down to the line, completing the profile of the frames.

The foot of the guide frames is a strip of $^3/_8$" × $^1/_8$" (10 × 3mm) brass. Mill a slot 20 thou (0.5mm) deep by $^1/_8$" (3mm) wide to form a location for the frame. In the centre of the slot, drill an 8BA (M2.2)

Continued on page 55



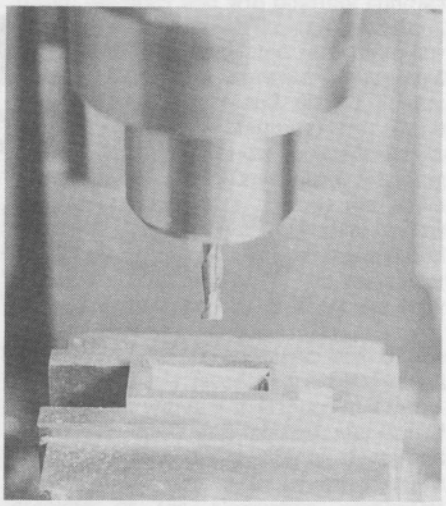
STEAMCHEST
1 off Gunmetal

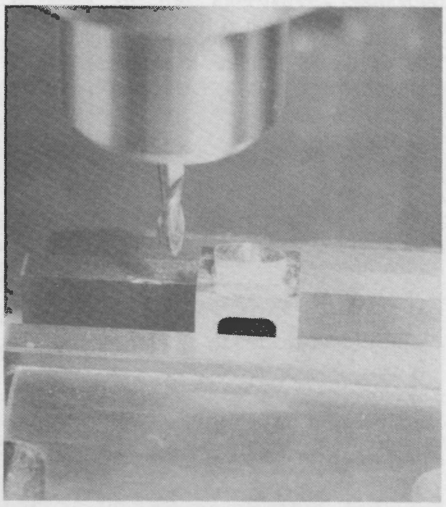
Top right: Milling the internal cavity of the steam chest.

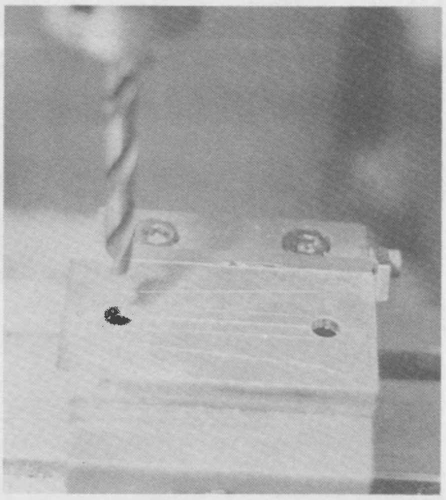
Right: Removing the bulk of the surplus material around the elliptical boss for the valve rod gland of the steamchest.

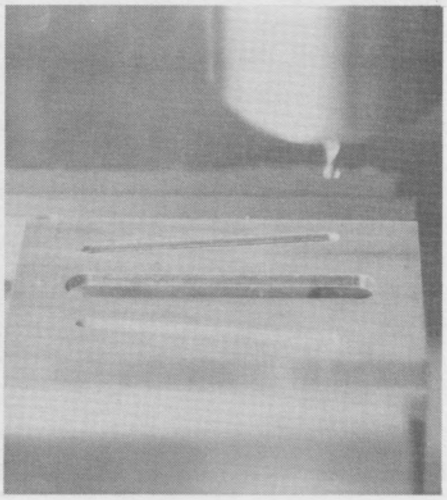
Below right: Drilling the holes at the ends of the slot in the guide frame.

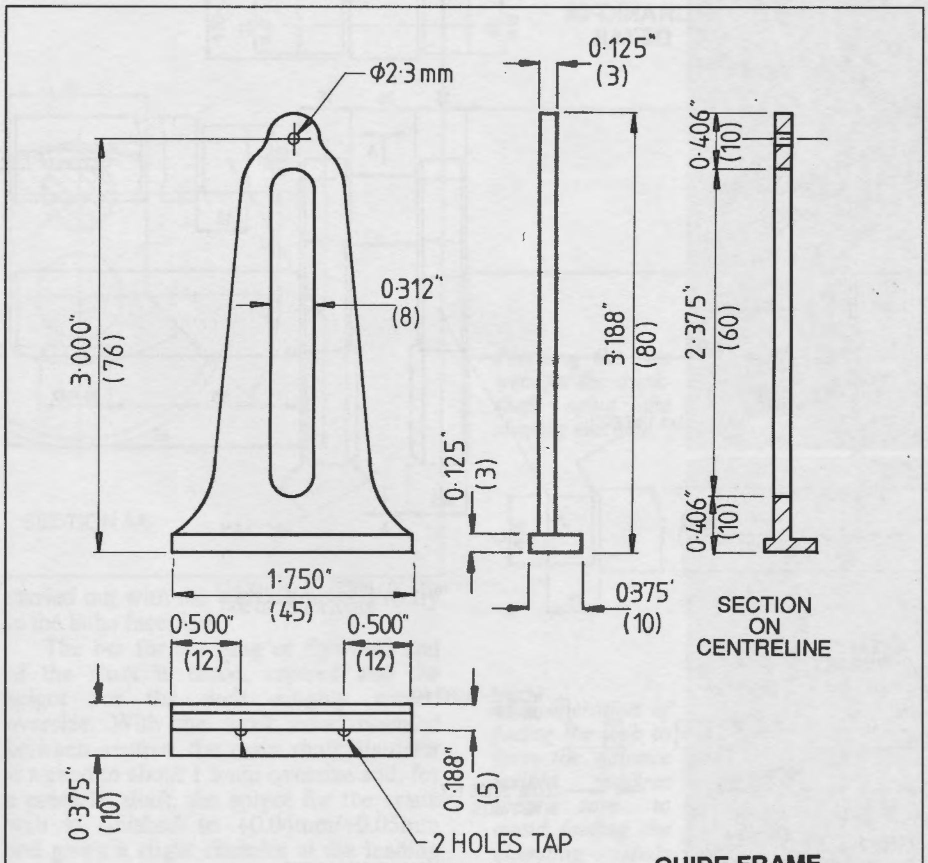
Bottom right: The central slot in the guide frame and the outer edges are formed with a slot drill.





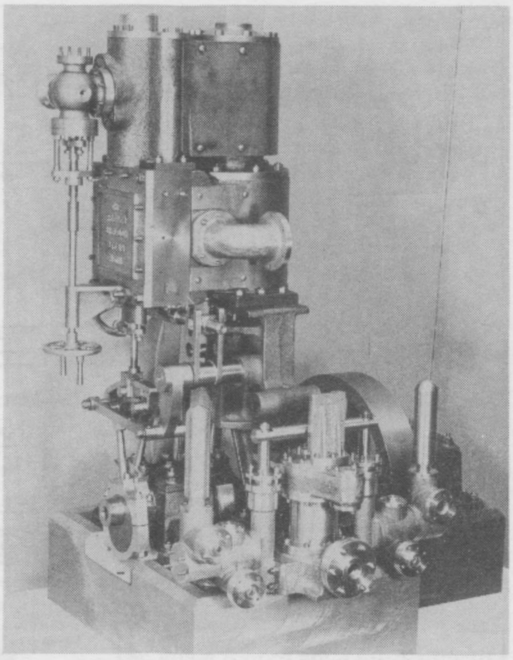






GUIDE FRAME
2 off Gunmetal or Brass

THE SHELDON COMPOUND STEAM ENGINE



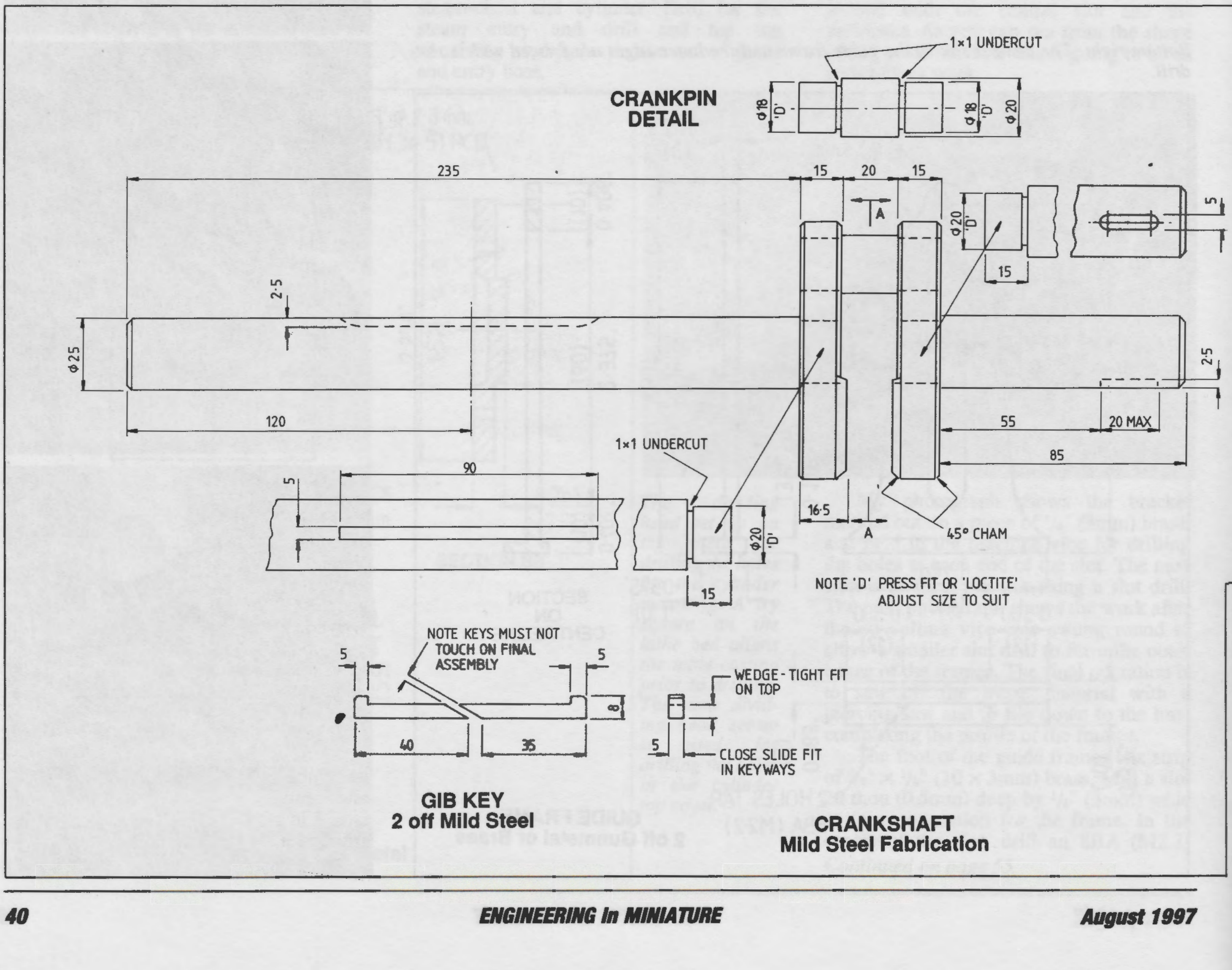
John P Bertinat

Part Fourteen

Crankshaft

The drawing as supplied calls for the use of either Loctite or a press fit for crankshaft assembly; I chose the latter, together with pegging, for a belt and braces approach. The press fitting was accomplished using drawbolts through hollow shafts, as used on my Clarkson compound steam engine and described in *Engineering in Miniature* some time ago. In the Sheldon engine, the flywheel end of the shaft is too long for drilling right through and a long tapped stud was employed instead. The Sheldon crankpin-big end bearing is the same size as for the Commander and some builders may question this point since, in the tandem compound arrangement, a single big end takes the load of both cylinders together. Based on these arguments a larger (in both length and diameter) big end would have been desirable, reducing the very generous length of the main bearings as necessary. The snag is that this change would have involved a considerable change to the base casting which was derived from one half of a Commander base!

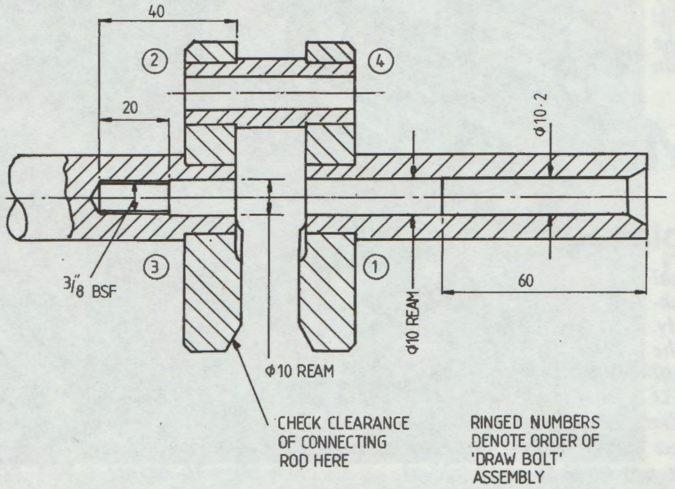
Flame cut steel blanks are supplied for the crank webs and the first operation is to face one side of each web, using a four-jaw chuck set-up. The shaft centre is then marked on the reverse side of the web and the work set up with this centre running truly and the previously machined face pressed hard against the chuck body or packed out parallel to it, if necessary, to clear the chuck jaws. The web is then faced to balance weight thickness and the crankshaft hole drilled, bored and, if possible, reamed to ensure that both webs have exactly the same bore. The work is



CRANKPIN DETAIL

GIB KEY
2 off Mild Steel

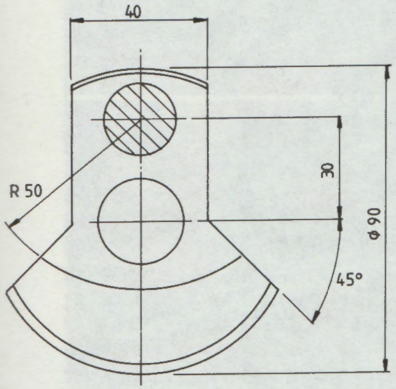
CRANKSHAFT
Mild Steel Fabrication


40
20
②
④
ϕ10·2
3/8" BSF
③
①
60
ϕ10 REAM
ϕ10 REAM
CHECK CLEARANCE OF CONNECTING ROD HERE
RINGED NUMBERS DENOTE ORDER OF 'DRAW BOLT' ASSEMBLY

ALTERNATIVE CRANKSHAFT ASSEMBLY

then mounted on a stub mandrel for turning the outside diameter of the webs.

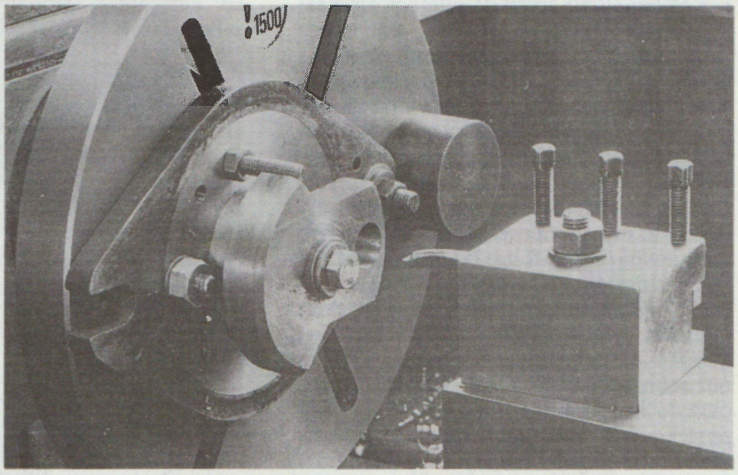
For machining the crankpin holes, a faceplate fixture consisting of a stub mandrel of diameter to fit the crankshaft bore and mounted with its centre 30mm (ie. crankshaft throw) from the lathe centre was used and is shown in my first photograph. The two webs, still of uniform thickness, were then dowelled together and transferred to a shaper or the milling machine for profiling the sides of the webs. The final relieving of the web centres to form the balance weights was carried out with the web clamped directly to the lathe faceplate.



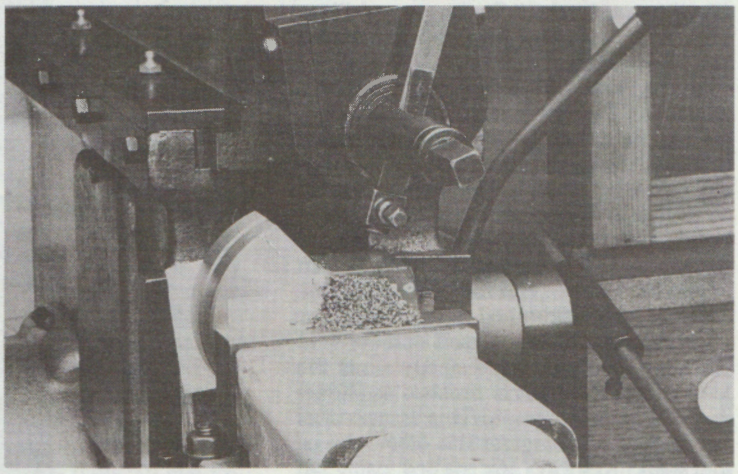
SECTION AA

The bar for the long or flywheel end of the shaft is faced, centred and the spigot for the web roughly turned oversize. With the work now mounted between centres. the main shaft diameter is turned to about 1.5mm oversize and, for a press fit shaft, the spigot for the crank web is finished to +0.04mm/+0.05mm and given a slight chamfer at the leading end (the allowance is purposely on the high side since the shaft is to be bored 10mm diameter and will possibly contract slightly during the forcing operation). Next the shaft is mounted in a three-jaw chuck, spigot end outwards, supported with a fixed steady and drilled 8.3mm diameter ($^{3}/_{8}$" BSF tapping) by 40mm deep. The hole is now opened out to 10mm diameter by 20mm deep, finishing accurately to size with a boring tool and a 10mm machine reamer if available – this part of the hole is for the aligning mandrel required during assembly. The remainder of the hole is tapped $^{3}/_{8}$" BSF for the draw bolt.

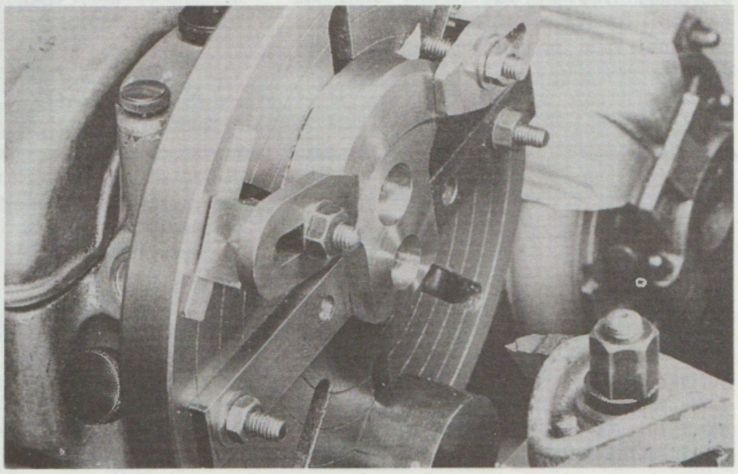
The shorter or eccentric end of the shaft is similarly faced, centred and rough turned, after which it is gripped in a three-jaw chuck, crank end inboard, and drilled 10.2mm diameter by 60mm deep and coned for a centre as shown in the drawing of the alternative crankshaft assembly. The shaft is then reversed in the chuck, drilled, bored and reamed to break



With the web set on an offset turning fixture on the faceplate, the hole for the crankpin can be bored.



Profiling the two webs for the crankshaft using the shaping machine.



This operation of facing the web to form the balance weight requires great care to avoid fouling the clamping studs and faceplate balance weight.

into the previous hole and the outer spigot turned to a force fit in the web as before.

The crankpin is likewise turned between centres to a press fit in the webs and drilled 10mm diameter for a draw bolt.

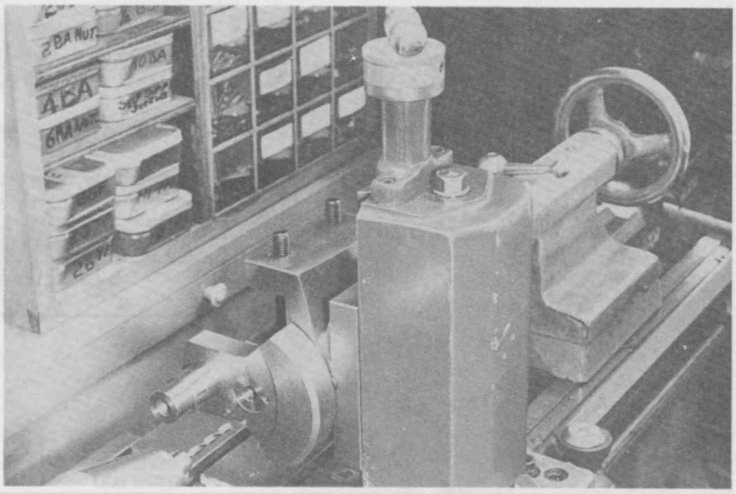
Care should be taken in selecting the draw bolts; the shoulders under their heads and the faces of the nuts used should be dead square with the bolt axis to ensure that the assembly is started truly. Likewise, the stud used with the longer section of shaft should, if not a piece of machine made studding, have its threads screwcut. The order of assembly should follow the numbering given in my alternative assembly drawing on the previous page and the locking pegs fitted half in the shaft and half in the web, dealt with as assembly proceeds. I used $^{3}/_{16}$" × 40 tpi threads for these pegs, adjusting the die to produce a tight thread all the way, the peg being finished flush after final tightening. I consider fitted screwed plugs preferable to the socket grub screws sometimes recommended for this purpose, since the screw material is intrinsically stronger. The screws are often made with a loose thread which only tightens up at the end of the thread and thus provides a less positive location.

For the final stage of the assembly (No. 4 in my alternative drawing), the two sections of the shaft are held in alignment by a 10mm diameter silver steel rod passed through the holes in the shaft sections. Incidentally, it may be found that the 10mm holes might require cleaning out with a reamer since they may have closed in slightly during the forcing process. My photographs opposite show the shaft aligned ready for the final squeeze and the final peg drilling operation with the drill held in an extension chuck.

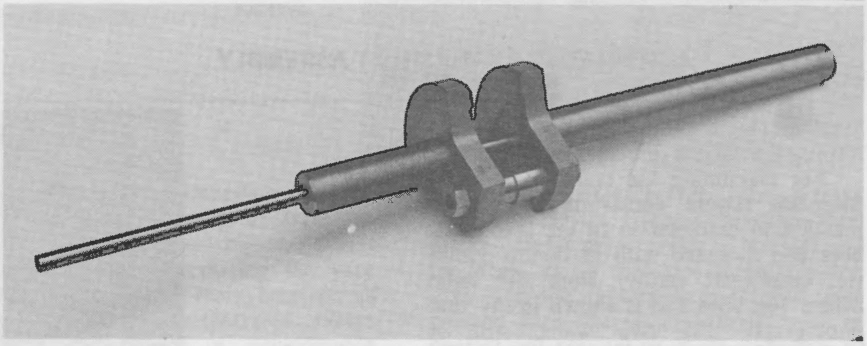
Now comes the critical test. With the completed shaft mounted between centres, the run-out should be minimal and, in any case, well within the machining allowance left on the shaft. The crankpin will need no further attention but the shaft, mounted between centres, is machined to its final dimensions. This is best carried out in stages, the short end of the shaft first being carefully skimmed to run truly, after which the work is reversed end for end and supported by a fixed steady while the long end of the shaft is finished as shown in my final photograph. This last process is repeated to complete the other end of the shaft. Keyways are milled using an end mill for the eccentric keyway and a side and face or slitting cutter at the flywheel end.

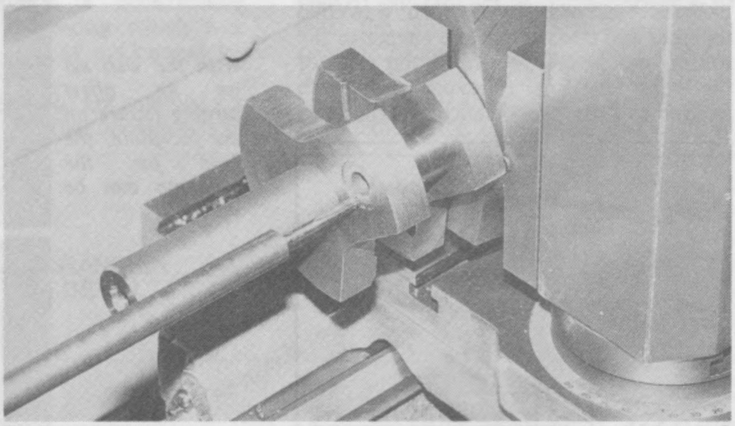
To be continued.

With half of the crankshaft assembled the hole for the locating peg can be drilled.

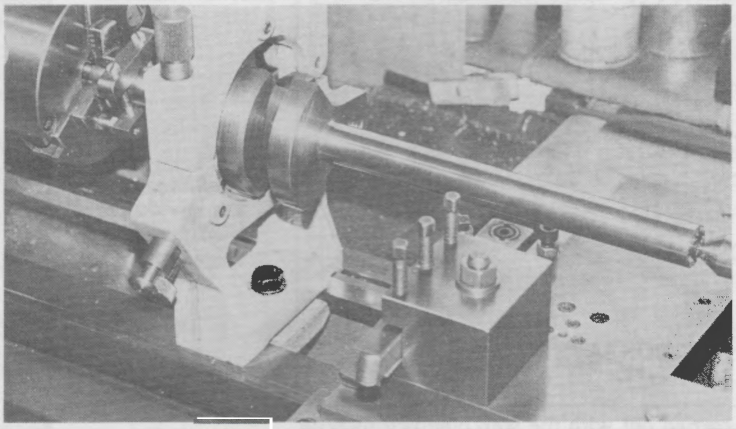


Below: The final stage of the crankshaft assembly. Note the use of the long aligning shaft as the web is drawn on to the crankpin.





Tapping the hole for the final locating peg using a tap with an extended shank.



The final turning on the assembled crankshaft.

ROBEY No. 4 LIGHT TRACTION ENGINE

Continued from page 45

5 degrees or so must be filed during the making. Harden the form tool by bringing it to red heat and quenching, polish it on an oilstone and then temper it to medium straw. Either surface grind if available or work the top surface on an oilstone to touch up the cutting edge which may have dulled during heat treatment. There, we have a form tool! In use, the lathe should be run between 60 and 100 rpm depending upon the width of cut, otherwise there will be tremendous vibration and chatter marks. So, with the form tool made, radius the end of the rod.

Bring the connecting rod out of the chuck and hold it by the machined flats at the big end, adjust the jaws until the $^{7}/_{32}$" witness diameter is running true and support the small end with a centre. Set the compound slide to 0 degrees 20' and turn the remainder of the shaft. The $^{3}/_{16}$" radius at the big end will also need a form tool, so bear that in mind when approaching that end. To combat spring in the rod, turn the outer half to diameter first, then move along and turn the second half. Any marks on the rod at the meeting can be polished out later, within reason of course.

To be continued.

Nº 4 LIGHT TRACTION ENGINE

A design in 2" scale

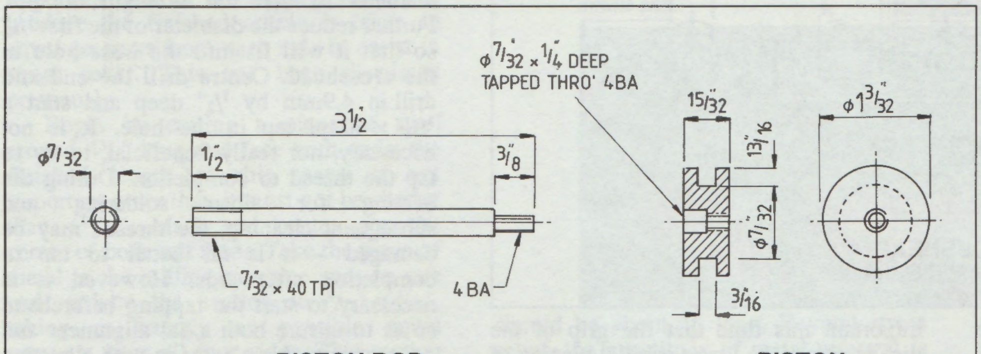
by IAN AMOR

Part Thirty-two

PISTON AND PISTON ROD ASSEMBLY

Begin this assembly by making the piston rod. Cut a length of mild steel or stainless steel rod 7/32" diameter and face both ends to a finished length of 3 1/2". Reduce one end to 0.141" diameter for 3/8" and thread 4BA and then thread the other end 7/32" × 40 tpi for 1/2" long. Set the rod aside and take up the piston casting.

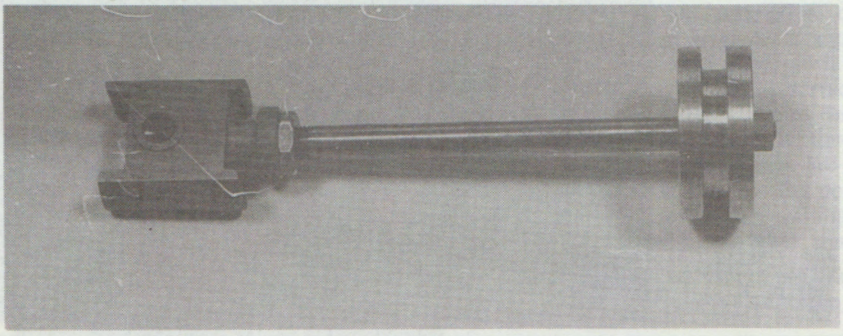
The piston casting has a chucking piece on one end, so start by gripping the casting in the chuck by the main body and skim the chucking piece to a good finish. Reverse the casting in the chuck, face the end of the main body and reduce the outside diameter to a little over 1 3/32". There is a school of thought that says the outside diameter of the piston should only be finish turned with the piston rod fitted and the rod held in a collet chuck. If that is what you do, then do it that way; however I don't think that that is necessary. The piston rod is fitted into the piston with a thread and a register similar to a lathe chuck and, provided that both this and the outside turning is done at the same setting, the piston and its rod will be concentric when assembled. The full size engine has the piston rod fitted on a taper with a draw thread, but the line has to be drawn somewhere!



PISTON ROD
1 off Stainless Steel (or Mild Steel)

PISTON
1 off Gunmetal

Assembled piston, piston rod and crosshead.



Centre drill the piston and drill in for around 5/8" deep with a 3.0mm drill. Open this out to 7/32", first with an undersize drill and finally with a small boring tool to 1/4" deep. It is on the closeness of this fit that the overall truth of the piston to piston rod depends. Lastly tap the 4BA thread. With a freshly sharpened tool the outside diameter of the piston can be brought to a running fit in the cylinder bore.

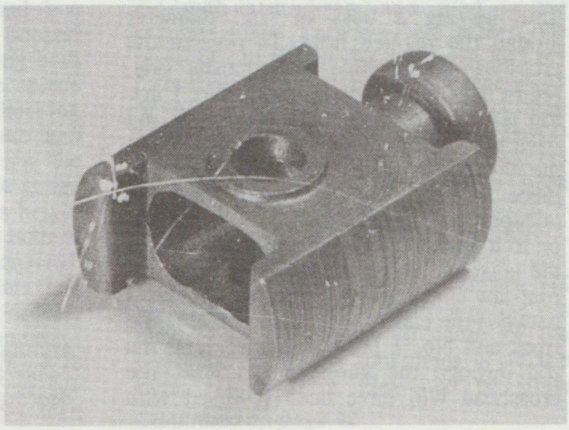
Next the groove for the packing can be machined. The groove has been designed for soft graphited packing because that is my preference; for 'O'-rings I must leave the design to those that wish to use them. I am not in favour of metallic piston rings in gunmetal and I have no knowledge of non-metallic rings for use with steam. Before cutting the groove, first obtain a length of packing (as Mrs Beeton may have said!). The groove needs to be about central on the piston so begin the cutting 11/64" from the faced edge. Use a parting tool, making the first plunge around 1/8" deep, retract the tool and move it towards the chuck so that the groove is then 3/16" wide and make a second plunge. The central rib, if any, can be removed and the bottom of the groove machined flat. Take the end of the packing and push a short length of it into the groove, pressing it with the fingers so that it fits the width fully. The amount the groove needs to be deepened can now be assessed. The finished position should be such that the packing is slightly above the piston surface, so that when the piston is pushed into the cylinder bore the fit is firm but not tight.

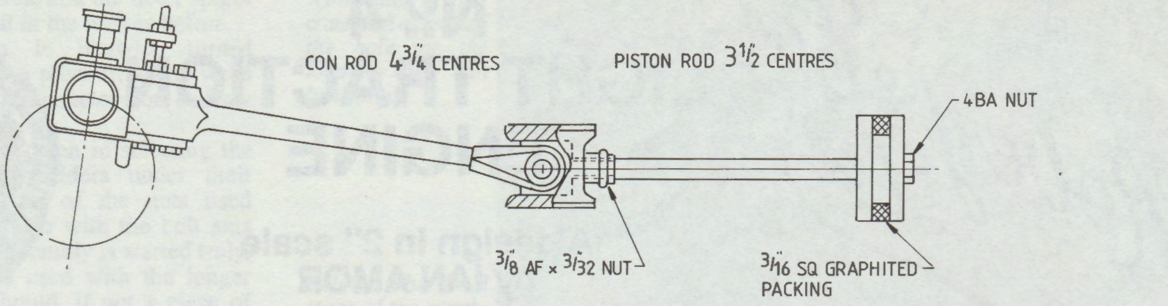
With all the machining finished, the piston can be sawn or parted from the chucking stub, reversed and mounted in the three-jaw chuck and faced to thickness. To complete the first part of the assembly, screw in the piston rod and fit a standard 4BA brass nut.

Attention is now turned to the crosshead on the other end of the piston rod. This is a steel fabrication, the neck which the piston rod screws into being silver soldered in place. Grip a piece of round mild steel bar of at least 7/8" diameter in the chuck, face the end and turn down a length of around 1" to 27/32" diameter or, more importantly, to a nice sliding fit in the trunk guide which should be used as a gauge. Centre drill and then drill in, also to a depth of around 1", finishing with a 19/64" or 7.5mm drill. The actual size of this hole is not so important – its purpose is to locate the neck which is to be silver soldered in, so it should be reduced just enough to allow a depth locating shoulder to be formed on the neck. Now this piece can be sawn or parted off and faced back to a finished length of 29/32". The next stage is to drill the gudgeon pin hole and face both sides to profile.

Mount a four-jaw chuck on the lathe, put the blank just produced in it and set the blank to run true with a dial test indicator. When it is so, move the No. 1 jaw to the 12 o'clock position, slacken the No. 1 jaw and the one directly in front and remove the piece. Anoint a small portion

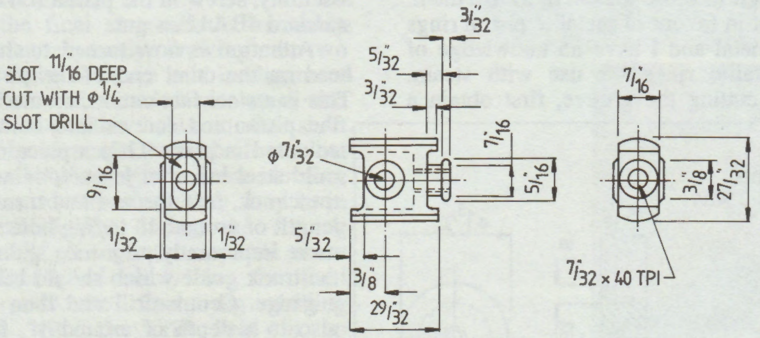
Right: The completed crosshead.




CON ROD $4^{3}/_{4}$" CENTRES
PISTON ROD $3^{1}/_{2}$ CENTRES
4BA NUT
$^{3}/_{8}$ AF × $^{3}/_{32}$ NUT
$^{3}/_{16}$ SQ GRAPHITED PACKING

ARRANGEMENT OF PISTON & CONNECTING RODS

of the periphery of the blank with marking out fluid and on this scribe a short line around the blank $^{3}/_{8}$" from the end. This has marked the height of the gudgeon pin hole. Return to the four-jaw chuck and withdraw the front jaw sufficiently to allow the blank to be refitted in the chuck, but now having been turned through 90 degrees to allow the gudgeon pin hole to be drilled. By just nipping up the No. 1 jaw, the hole to be drilled will still pass through the centre of the blank, the only adjustment required being on the two horizontal jaws to bring the scribed line into coincidence with the tailstock centre. There needs to be a bare $^{1}/_{4}$" of blank protruding beyond the chuck jaws for facing.



CROSSHEAD
1 off Mild Steel

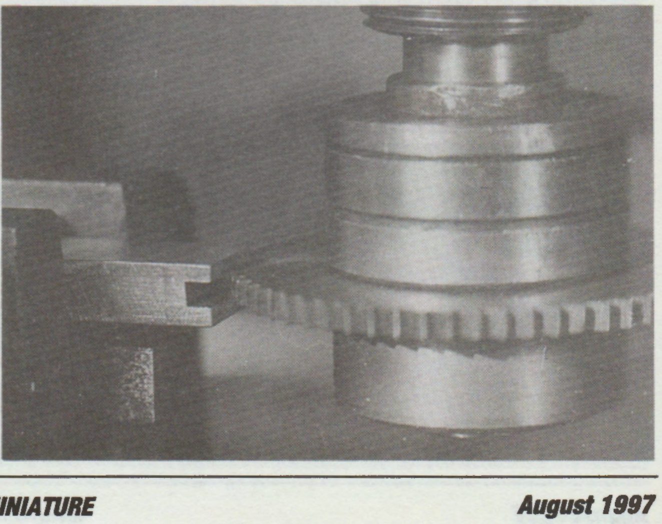
Begin the machining by drilling with a centre drill and follow on with a 5.3mm drill, finishing with a $^{7}/_{32}$" reamer. Bring up the facing tool to just touch the work, lock the saddle and set the compound slide micrometer collar to zero. Face off 0.172" fully across the blank. Change the tool to one which has a small radius on the cutting edge, if it hasn't already got one, and face away a further 0.031", this time leaving a boss of $^{7}/_{16}$" diameter around the reamed hole. To reverse the crosshead to machine the opposite side, return the four-jaw chuck to the No. 1 jaw top position; slacken both the No. 1 and front jaws and remove the crosshead from the chuck. Put either the $^{7}/_{32}$" reamer or a piece of $^{7}/_{32}$" diameter rod into the tailstock drill chuck and slip the crosshead on to it with the unmachined side towards the tailstock. Bring the tailstock up to the four-jaw chuck and position the crosshead between the chuck jaws. By tightening the front and No. 1 jaws whilst keeping the rod through the gudgeon pin hole, the crosshead will have been reversed with sufficient accuracy to machine the second side. Retract the tailstock and turn the second side in the same way as the first.

Transfer the crosshead to the milling machine, gripping it in the vice across the thickness of the crosshead with the neck end uppermost. Check against the rounded bearing surfaces of the crosshead for verticality. Mill out the $^{9}/_{16}$" × $^{3}/_{32}$" deep portion on the end, ensuring that the relief is symmetrical about the centre line. Reverse the crosshead in the vice so that the opposite end is now uppermost. It is important this time that the grip of the vice is across the lower parallel portion of the sides and not across the gudgeon pin bosses. It is possible, if the grip were to be across the bosses, that as the crosshead is progressively hollowed out the spot pressure on these bosses would force the thinned sides inwards. This would have two effects, firstly the bowing sides would be thinned further, thus altering the profile of the sides when the pressure is released and secondly, with the movement of the bosses inwards, the vice jaw pressure would be lessened, compromising the security of the set-up.

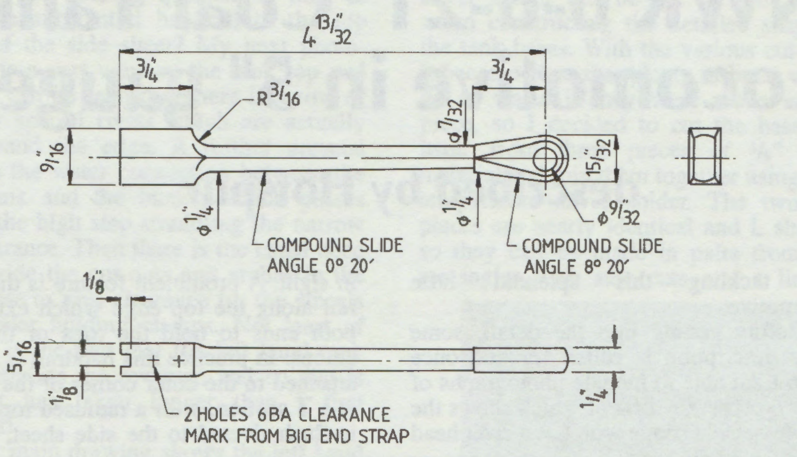
With the crosshead held securely in the vice and with the rounded sides vertical, the remainder of the milling can be completed. Begin by cutting the front end $^{9}/_{16}$" × $^{5}/_{32}$" deep relief. This also should be symmetrical about the centre line. A $^{1}/_{4}$" diameter slot drill should now be fitted to the milling machine. If travel stops are available on the mill, they should now be set to limit the width of the slot to $^{5}/_{16}$" and the length to $^{9}/_{16}$"; if they are not, take great care particularly on the width. Progressively cut the slot to $^{11}/_{16}$" deep. The crosshead can now be removed from the vice, deburred and set aside.

Face the end of a piece of $^{7}/_{16}$" diameter mild steel bar and reduce the diameter to $^{5}/_{16}$" for a length of $^{9}/_{32}$". Further reduce the diameter of the first $^{1}/_{8}$" so that it will fit into the boss hole in the crosshead. Centre drill the end and drill in 4.9mm by $^{1}/_{2}$" deep and start a $^{7}/_{32}$" × 40 tpi tap in the hole. It is not necessary, nor really beneficial, to try to tap the thread to completion. During the heating for silver soldering and subsequent cleaning, the threads may be damaged – it is far better to tap to completion afterwards. However, it is necessary to start the tapping beforehand so as to ensure both axial alignment and concentricity. Next enter in with a parting tool leaving a $^{3}/_{32}$" wide flange of the full $^{7}/_{16}$" diameter bar at the end of the reduced diameter portion. Round this flange over with either a file or form tool and then part off completely.

Socket the boss into the crosshead, ensuring that the joint is well fluxed beforehand, wire the two pieces together and silver solder them. Clean up the assembly and complete the tapping of the $^{7}/_{32}$" × 40 tpi thread. To complete the



Milling the end of the connecting rod to take the bearing adjusting wedge.



CONNECTING ROD
1 off Mild Steel

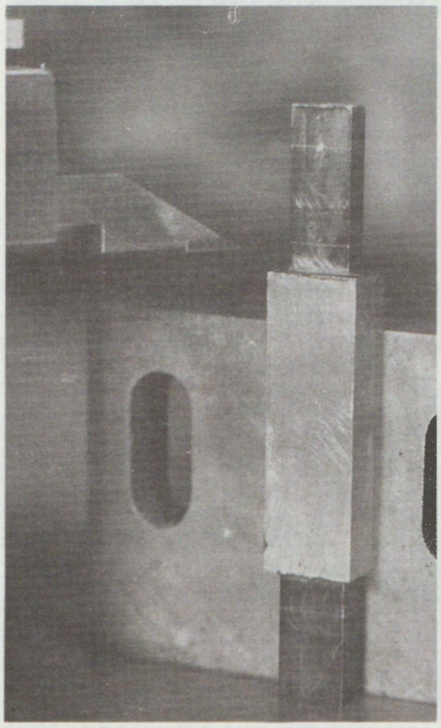
whole assembly, a $^{3}/_{32}$" thick, $^{3}/_{8}$" A/F nut tapped $^{7}/_{32}$" × 40 tpi needs to be made to lock the crosshead on to the piston rod.

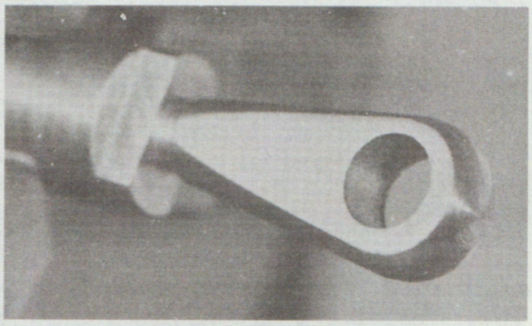
CONNECTING ROD ASSEMBLY

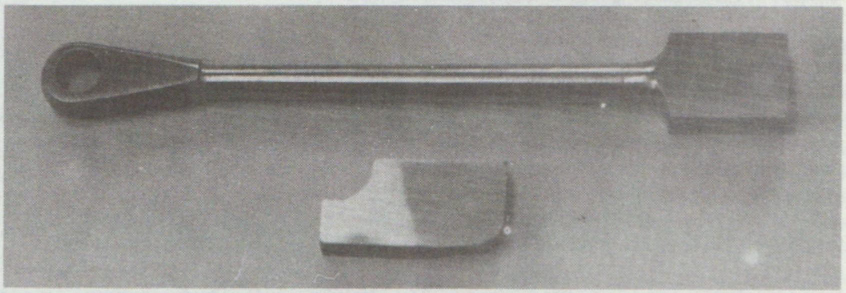
The first part to be made must be the rod itself. This is machined out of rectangular section steel, the actual size of which is unimportant as long as the big end section of $^{9}/_{16}$" × $^{5}/_{16}$" can be produced. Whatever size is used, it is important that all the metal removed to produce the finished article is taken in equal amounts from each side to assist in stress relief. This has been discussed previously.

Begin by cutting a piece of steel around $4^{3}/_{4}$" long and face both ends; the finished length at this stage is not important other than it must not be shorter than $4^{41}/_{64}$". Mark and centre pop the centre of both end faces. Take the piece of metal to the milling machine and, on one end, reduce the section to $^{9}/_{16}$" × $^{5}/_{16}$", taking as exactly as possible equal amounts from all four sides. This section should be about 1" long. Beyond stress relief, the exactitude of metal removal is also essential for setting up later. On the other end of the piece, reduce the section to $^{15}/_{32}$" × $^{1}/_{4}$", this time the section should be about $1^{1}/_{4}$" long. The relationship of both ends to each other is obvious from the drawing. Across the $^{9}/_{16}$" × $^{5}/_{16}$" end, mill the $^{1}/_{8}$" × $^{1}/_{8}$" slot for the wedge. This is most certainly easier using a $^{1}/_{8}$" thick circular cutter, but can of course be done using a slot drill.

Anoint the $^{15}/_{32}$" × $^{1}/_{4}$" end with marking out fluid and set the piece on edge on the marking table. Using a height gauge, pick up the centre of the end face which was previously marked and popped and scribe a line at this setting along both vertical faces. Next stand the piece upright against an angle-plate, checking the side with an engineer's square and with the blued end uppermost. Set the height of the scriber on the surface gauge to $4^{13}/_{32}$", then scribe a line at this height around all four sides ensuring that both of the previously marked lines are crossed. Centre pop one of the crossing points then return the piece to the milling/drilling machine and drill through $^{9}/_{32}$" diameter.


Marking out the connecting rod blank.


Right: A close-up view of the small end of the connecting rod – the main shaft has yet to be turned.


Below: The finish turned connecting rod together with the form tool for turning the small end.

Now take the connecting rod blank to the lathe and mount it in the four-jaw chuck. The blank needs to be set well back in the chuck, gripping it by the as yet unmachined surfaces with the small end, the drilled end, outwards. Set the marked centre to run true. Measure the thickness of metal between the $^{9}/_{32}$" hole and the side of the con-rod and then face back the end to the same dimension. Enter with the smallest centre drill – this will be needed to provide support when the shaft is turned and the centre itself will not be visible when assembled.

Mount a parting tool in the toolpost and position it to cut a groove $^{3}/_{4}$" along the con-rod from the crossing line of the small end $^{9}/_{32}$" hole. Enter with the parting tool until a witness diameter of $^{7}/_{32}$" remains. Set the compound slide over to 8 degrees 20' – the exactness of the 20' of angle is not desperate but it is one third of a degree and as such, should be reasonably easy to judge by eye! Begin cutting the taper – the theory is that when the cut just begins at the crossing line of the small end hole, the end of the taper will be just $^{1}/_{4}$" diameter. Watch both ends of the taper and adjust your settings if necessary. To finish off this end a radius form tool will be required. I feel sure that I have mentioned form tools before, but for the life of me I cannot see where; however, as there are going to be several needed, I shall describe them now. The ideal material is an old, worn out large file. Anneal the file thoroughly to red heat and hold it there for some minutes before burying it in lime or fine ashes to cool slowly overnight. This metal can then be cut with a hacksaw and filed to the required shape. I always have at least one piece of old file in the cupboard and my form tools are rarely bigger than the width of the file by $^{1}/_{2}$" to $^{3}/_{4}$" long, and often have a different form at each end! This is for economic reasons – not of material but of effort; the metal may have been annealed but it is still tough!

File the form tool blank all round, ensuring especially that the teeth have been removed. Either blue the surface and cut to a marked line or file to a gauge – it makes little difference. Because of the requirements of the tool there is no top rake, but a front clearance of some

Continued on page 42

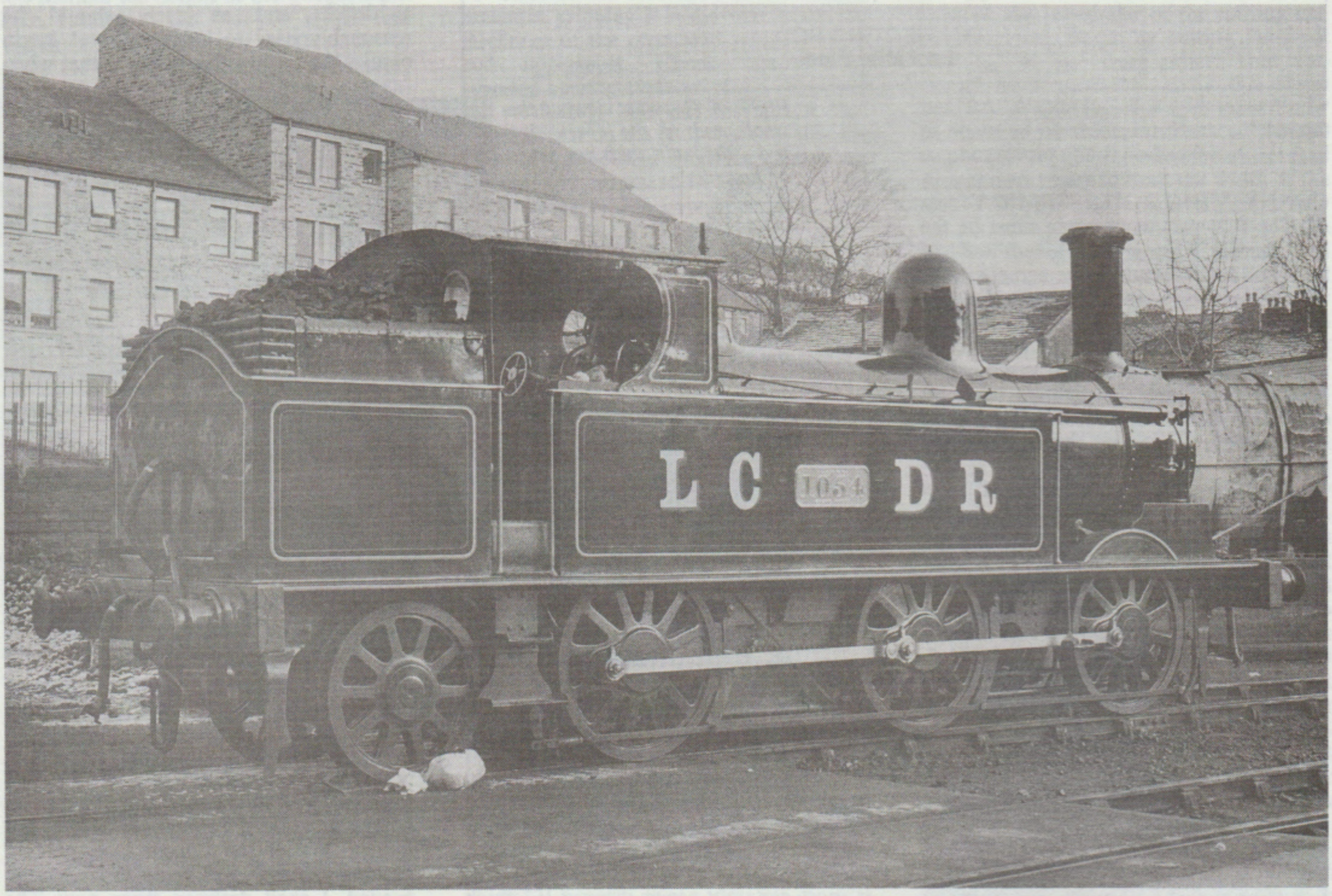
LNWR 0-6-2T 'Coal Tank' Locomotive in 5" gauge

described by Hotspur

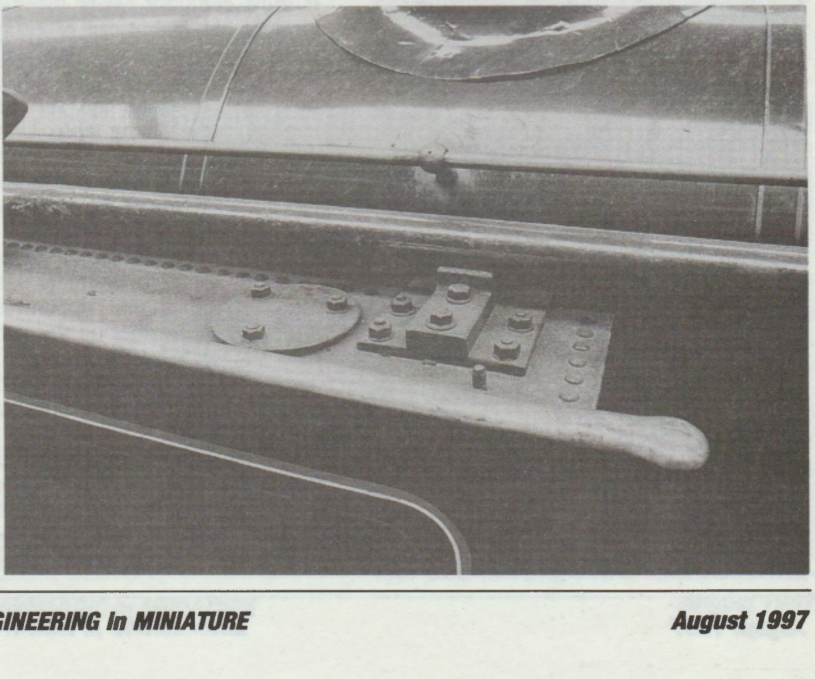
Part Forty four – Constructing the Side Tanks

We come now to the making of the two side tanks which are rectangular and what most of us may consider to be a simple job. Initially I thought the same, but it was only when the full size locomotive was studied in detail that some of the aspects became more involved. None of it is difficult; it has just taken longer. At the same time, large pieces of brass are costly and even in model engineering it is necessary to consider the most economic and practical use of materials, otherwise the design has not been fully thought through. Builders should not be put off and I trust I shall be able to describe the various components, with an order of assembly, so that the construction is suitable for anyone tackling this splendid little locomotive.

Before getting into the detail, some basic description is called for and once again I am able to include photographs of the prototype; the first of which shows the simple outside shape with not a rivet head in sight. A prominent feature is the handrail along the top edge which extends at both ends to hold the tops of the stanchions. In practice this handrail is not just attached to the outer corner of the tank; it is a T section, with a radiused top, which is flush riveted to the side sheet, the top



Above: The prototype preserved Coal Tank locomotive in special disguise for filming and showing the very plain platework. Photograph courtesy of John Fairclough.



Right: Another view of the prototype showing the front of the right hand side tank. Photograph courtesy of John Fairclough.

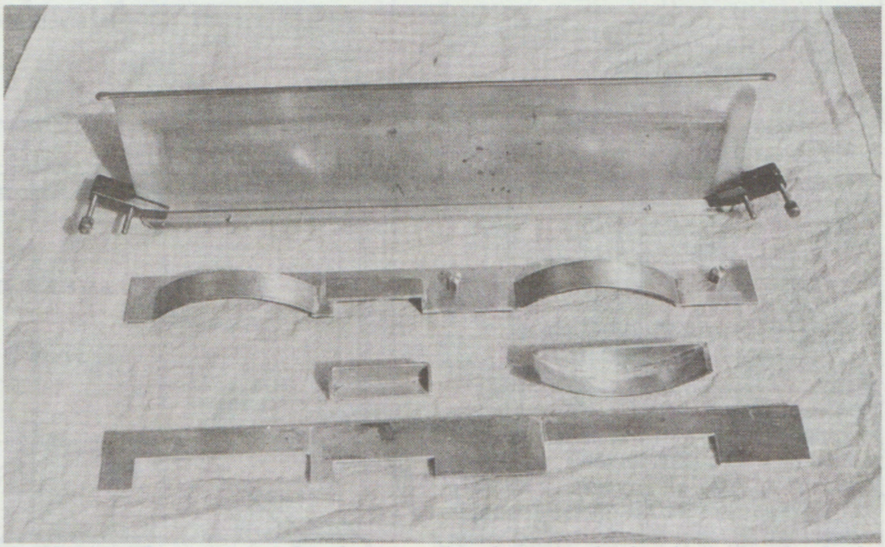
edge of which stands proud of the tank. So the first teasing question is how to attach a substantial handrail to the top edge of the side sheet? My next photograph is a part view of the tank top and here it can be seen that there is a row of closely spaced rivets which are actually all around the edge. A further unusual item is the water connection between the side tank and the bunker which passes under the high step straddling the narrow cab entrance. Then there is the usual need to provide the cut-outs and arches in the tank base to give clearance for the wheels and boiler holding clamps. Not least of course is the fact that the left hand tank also supports the reverser, and so that is why it has taken longer than I first thought!

My main drawing shows the left hand tank, but to show the construction it is a view from the inside to show the detail. As indicated above, the choice of material for the handrail and the method of joining it to the outer side sheet really set the marker for the rest of the assembly. I did not consider that a brass beading soft soldered to a thin edge would be strong enough; and anyway, the handrail should be polished steel! So the use of 16 swg material for the outer side sheet and a steel strip silver soldered in place to form the handrail gave a positive start. My strip was cut down from a piece of $^3/_{32}$" plate material and left a full 16" long by $^5/_{16}$" wide for its whole length to start with. The outer sheet was cut to its finished size with the edges square and parallel. Both parts were made as straight as possible and the sheet placed upright and centrally on the strip, on the usual firebrick(s), for silver soldering. Working carefully from one end, I added the silver solder from the side designated to be the inside of the tank (so the outer edge would be free of any lumps). After cooling and cleaning there was some distortion which was easily corrected.

To reduce the handrail strip to width along its whole length, it can be filed quite quickly and evenly if a scrap of $^1/_{16}$" plate is used to 'thickness' each side in turn. To do this, clamp the side sheet to a piece of 3" × 2" planed timber, held horizontally and slightly protruding, in the vice. Use 'G' cramps and the $^1/_{16}$" plate will prevent them marking the brass side sheet.

For those with the equipment, it is also possible to clamp the sheet to a milling machine table and reduce the strip to thickness by working along in stages. Place the lower half of the strip in a tee slot and clamp the sheet with a stout bright mild steel bar about two feet long held at each end by 'G' cramps. The length of the cut required has to stop short of the ends of the side sheet before the handrail broadens out. A large fine file is needed to round off both sides and the top of the strip, then the wider radiused end sections can be formed. Any tendency for the plate to still be distorted can be overcome later when the tank body is assembled. After this success, the side sheets were left while the bases of the tank were made.

Those who have been following my methods will know that I like fabricating parts, and so the use of varying grades of silver solder can be put to good effect when constructing the detailed shape of the tank bases. With the various cut-outs, it became clear that plenty of brass would go to waste if they were made in one piece, so I decided to cut the baseplate itself from three pieces of $^1/_8$" thick material and join them together using high temperature silver solder. The two end pieces are nearly identical and L shaped, so they can be made in pairs from two rectangles with saw cuts and a line of small holes; only the centre sections will have a nominal area of waste. The edges to be joined should be prepared by adding a 45 degree chamfer on either side where they touch and, when ready, lay two of the pieces on the much used flat firebrick and align them with a straight edge. Hold them with some extra bricks and, after fluxing, heat the joint until the silver solder will run into a small pool. I found the thick brass withstood the high silver soldering temperature without any problem. When cool enough, move the pair along and add the third part.



A selection of components for the two sidetanks; note the handrail already on the sidesheet and the joints in the baseplates.

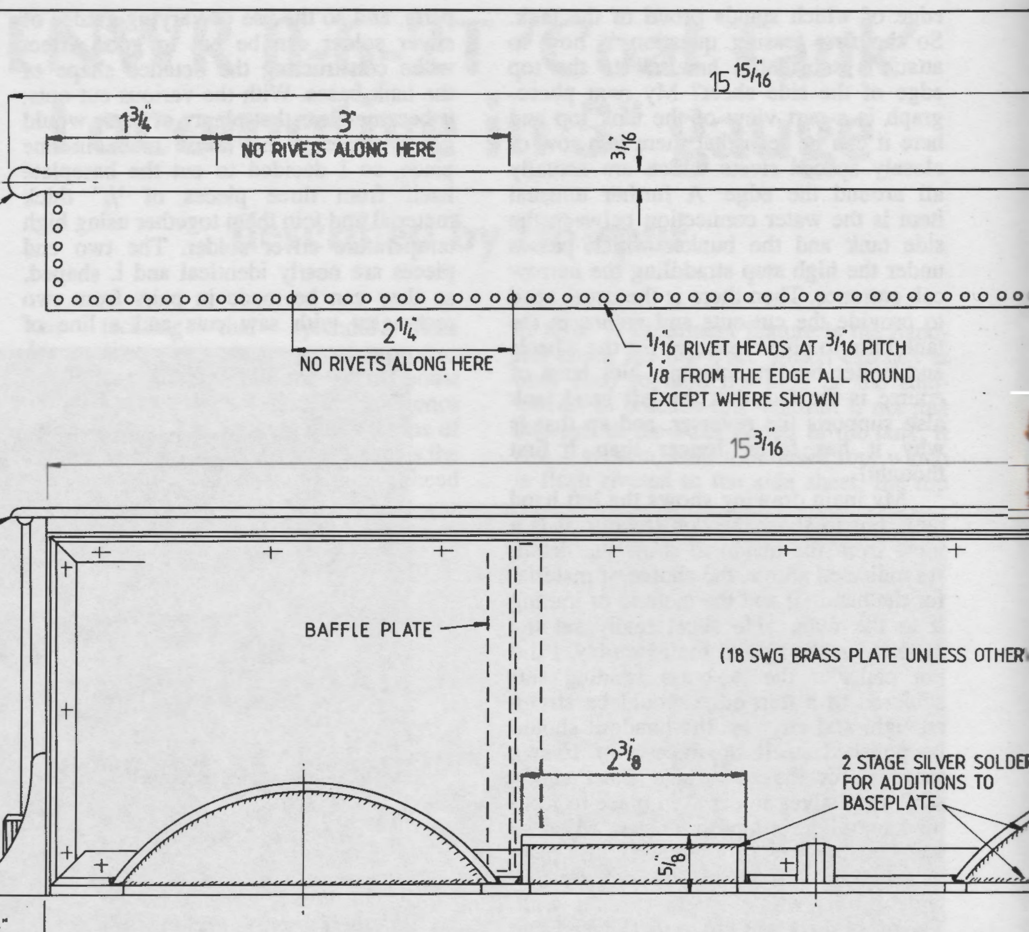
It will be no surprise that the straight edge does not remain so, but it is easy to knock the assembly back into line with a small mallet and to use a tap or two to ensure it is flat along its length. Now make up the arches for the wheels. These are very similar to the front splashers, except that the segment is flush with one side and joined again using the high melting point silver solder. The same sort of fabrication applies to the recess around the boiler clamp bracket and I actually used pieces of copper for these. After each set of parts has been fabricated, they should be filed square and flat on their joint lines and then silver soldered with Easi-flo to the baseplates. It will then be necessary to use the mallet again and bring the bases back to the straight and flat condition.

Having completed the base assemblies, it is now necessary to add the two fixing bushes. I have used two; one in each of the open spaces at the front and near the centre of the tank bases. (A third fastening position uses a bracket attached to the rear end plate of each tank which is clamped under the single bolt used to hold the cab steps.) Check the location of each base on its running board so that it is centrally positioned between the holes for the vertical stanchions. If you have allowed for the thickness of the end plates to be fitted to the tanks such that the overall length is kept to $15^3/_{16}$", there should be a full $^9/_{32}$" between the edge of the base and the centre of the stanchion holes at each end. They should also be $^7/_{32}$" in from the outside edge. The holes through the running board are arranged to be just to the special side frame brackets that were made so long ago, so be sure to check their position on the assembly.

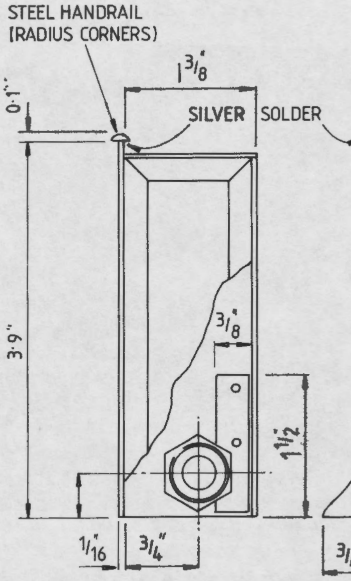
Once totally satisfied, drill the No. 30 holes for the fixing bolts through the bases and the running boards first. Each will take a 5BA bolt from underneath to hold a rebated clamping plate. Enlarge the holes in the tank bases to $^7/_{32}$" and tap them $^1/_4$" × 40 tpi. Now turn, thread and fit the bushes. Mine are bronze hexagon to enabl me to tighten them in place and then soft solder to seal them.

It is now time to turn to the rest of the construction. Most of it is the cutting of brass angle and the tinning of both the platework and the angle before holding these parts together with a few rivets. The angle used can be $^1/_4$" or $^5/_{16}$", but do make sure that it is square. If it isn't, squeeze the angle in the vice with a short length of suitable round bar between the two sides. Where it is awkward to drill after attaching one side, position the ends and tack them temporarily to drill them. With the thick material, it is is possible to put countersinks on the outside, fit the rivets and file them off flush. If preferred, use countersunk brass screws underneath the bases where they can stay and not be seen. It is rather a tedious task to cut and chamfer all the angle material at 45 degrees but there is no short cut to keeping the joints leak free. Put the various pieces of angle on the base, clamping and tack soldering them in place and adding a sprinkling of rivets for security as construction proceeds. Offer the main side sheet into position to check the overall length and here I used the heavier angle to maintain the straightness.

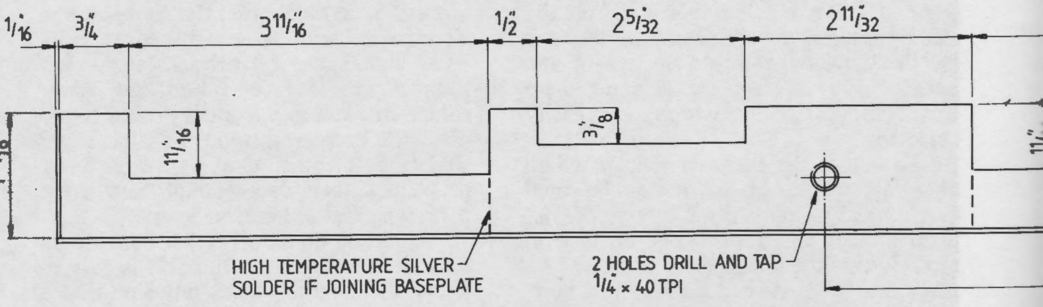
Make sure that the end plates can be fitted to be within the overall length of the



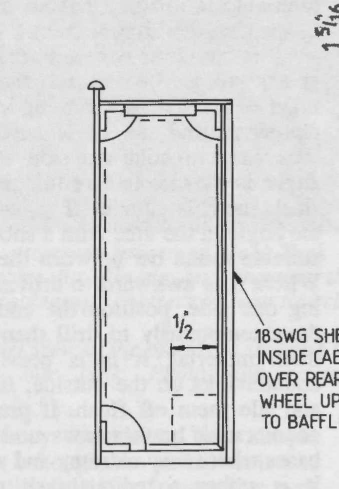
TOP & INSIDE GENERAL ARRANGEMENT OF LEFT HAND SIDE TANK



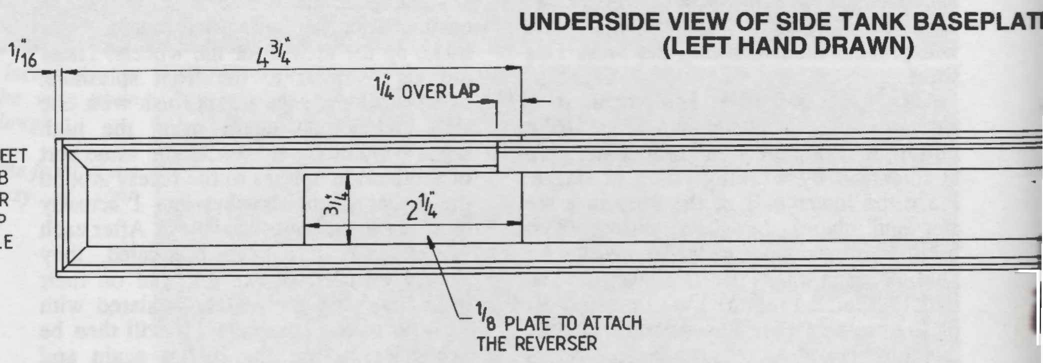
PART VIEW / SECTION AT CAB END SHOWING 3/8" BSP UNION


1/16
3/4
3 11/16
1/2
2 5/32
2 11/32
1 5/16
11/16
3/8
HIGH TEMPERATURE SILVER SOLDER IF JOINING BASEPLATE
2 HOLES DRILL AND TAP 1/4 × 40 TPI

UNDERSIDE VIEW OF SIDE TANK BASEPLAT (LEFT HAND DRAWN)



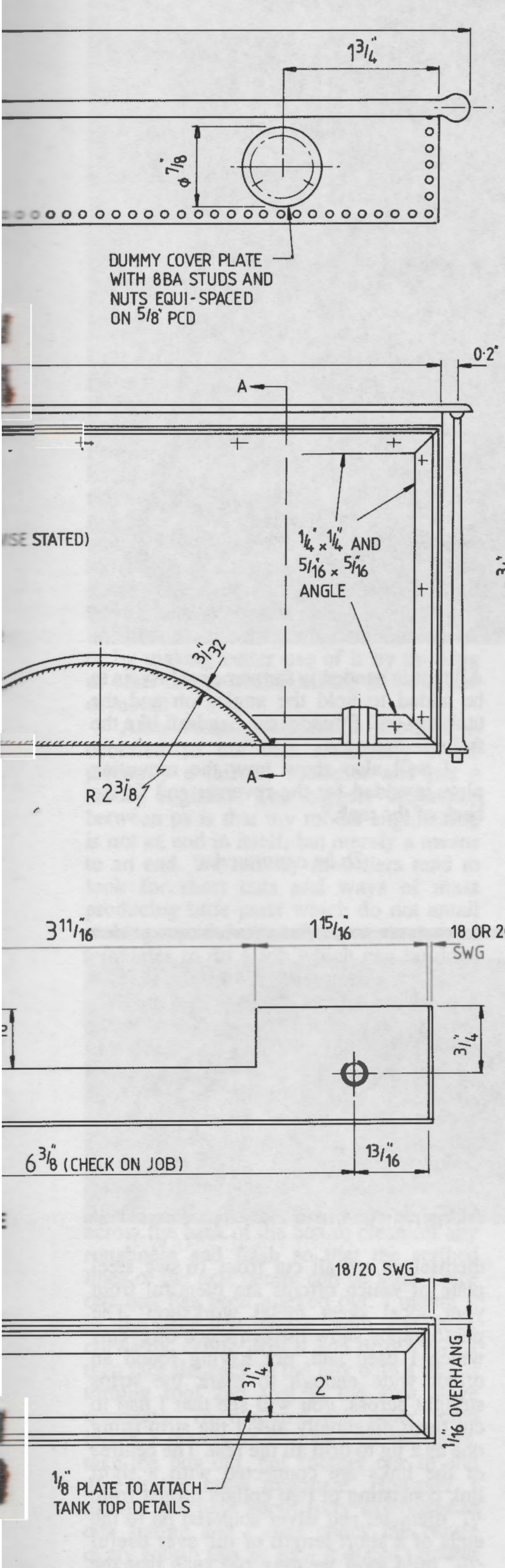
BAFFLE PLATE POSITIONED TO STIFFEN JOINT AT BACK OF TANK

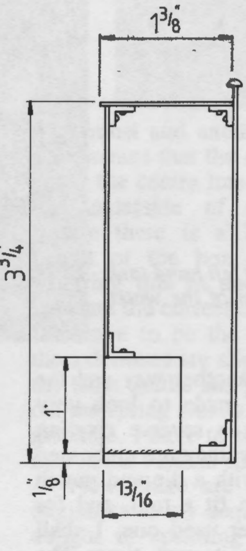


UNDERSIDE VIEW OF TANK TOP (LEFT HAND DRAWN)

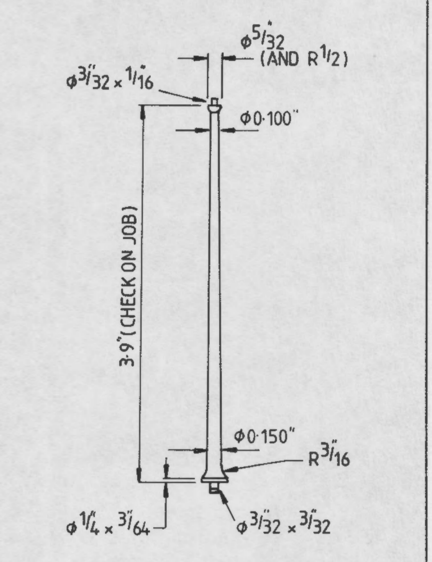
side sheet as now is the time to 'adjust' the length of the base if they do not. The rear plate is also fitted with the water connection to the bunker and here I used a large brass union cut in half and soldered and riveted into place after the bottom angle had been added. Last of all, the bracket which provides the third point of attachment is bent up and silver soldered in its corner. Then it is cut away to fit around the union and attached with more rivets which also hold the angle on the inside. The front plate has no such complications, but do note that the internal angles are set inwards at this end and top and bottom as far back as the rear coupled wheel arch.

Before attaching the end plates with

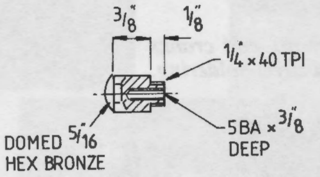

1 3/4"
ϕ 7/8
DUMMY COVER PLATE WITH 8BA STUDS AND NUTS EQUI-SPACED ON 5/8" PCD
0·2"
A
SE STATED)
1/4" x 1/4" AND 5/16" x 5/16" ANGLE
3/32"
R 2 3/8
A
3 11/16
1 15/16
18 OR 20 SWG
3/4
6 3/8 (CHECK ON JOB)
13/16
18/20 SWG
3/4"
2"
1/16" OVERHANG
1/8" PLATE TO ATTACH TANK TOP DETAILS



SECTION AA



HANDRAIL STANCHION
4 off Stainless Steel



FIXING BUSH
4 off Bronze

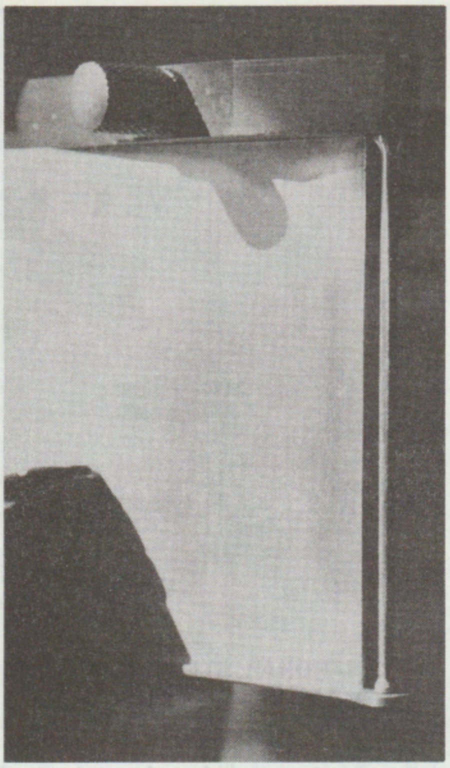
their angles, it is necessary to turn the stanchions so they can be silver soldered to the ends of the handrail. Check the height from the underside of the tank handrail from the running board to confirm the length of each stanchion. Use 1/4" stainless steel and allow about an inch to protrude from the chuck. Begin with the small end and note that the 3/32" registers on both ends have to locate in a shallow hole drilled up into each end of the tank handrail and the opposite one already in the running board. Run your lathe as fast as possible and use plenty of cutting oil. Turning such a gradual taper is a bit of guesswork to start with, but it approximates to 0.012" increase in diameter per inch run. If it helps, my topslide was set about 2/3 of a degree.

Before parting off the stanchion, just check the surface finish left by the turning tool. My stanchion had very small rings in it from the joins between the sections of taper turning and if a polishing grade of emery tape is used, they show up and look awful; so dress them with a very fine needle file and they should disappear. My personal view is that although our locomotives were kept well cleaned, the brightwork did not gleam like chrome plate and so leaving these stanchions in a sparkling state is incorrect. I suggest that the best finish is to rub the parts lengthways with the fine tape but without the lathe running and then leave them alone.

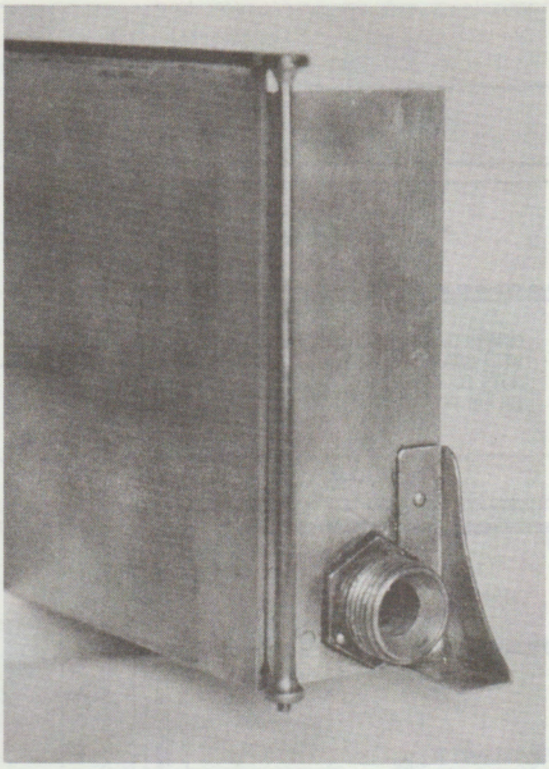
To prepare for the silver soldering, it was easy to hold the side sheet upside down in the vice to carefully mark out and drill the blind hole. Do not go right through or the effect will be spoilt. Check that there are no burrs and the stanchion sits properly in both its location holes; then use a small toolmakers clamp resting on the underside of the tank to hold the free end of the stanchion upright for the silver soldering. Now all that is needed is to apply the flux and heat the very end of the **handrail** with a fine flame. The heat works back to provide sufficient for the minute amount of Easi-flo silver solder required and does not cause any distress to anything else.

I thought it sensible to include at least two baffle plates equi-spaced down the tanks, with their corners cut away to clear the angles and flanged to be attached to the base, sides and top. These not only help to stop the water sloshing about, but assist in keeping the tank square, especially if that outer sheet is a little wavy.

Line up the angle on the outer sheet



Left: A vertical stanchion being supported upside-down by a toolmakers clamp to be silver soldered to the underside of the handrail end of the tank.



Right: The rear end of the left hand tank showing the female union of the water connection to the bunker.

below the handrail to take the tank top and drill its rivet holes as soon as practicable, **but do not fix it permanently**. Before this can happen, the top must be made and this means organising all the rivets around its outer edge.

The rivets to be fitted around the outer edge of the side tanks can be proper ones put into drilled holes and cut and swaged in to hold the brass angle, but there are about 180 of them on each tank top! Fortunately, there is another way and the finished part can be made to look very convincing by using a reverse riveting punch. In other words, they are embossed from the underside with a die and punch set which is made to fit a tool, and for those who have never used one, I shall include a sketch for it next time. The dimensions of the die and the setting of the fence stop on the tool give the pitch of the rivets automatically as the tool is used. All that is needed is for some real rivets to be added to hold the angles on and the tank top will fit under the handrail like the full size example.

I will also show how the mounting plate is added for the reverser and fit the back of the tank.

To be continued.

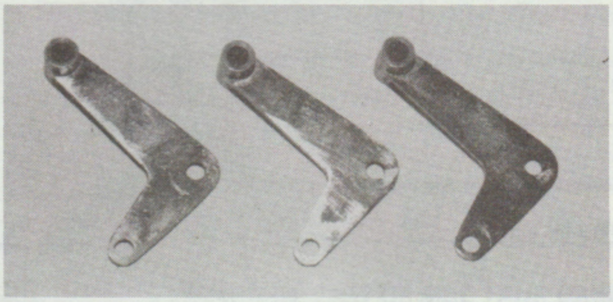
LNER 20 TON BRAKE VAN

Continued from page 53

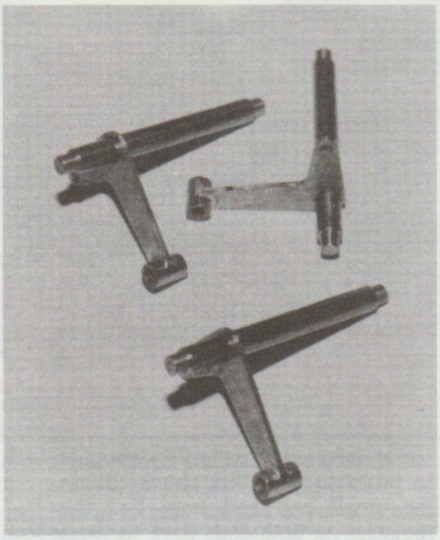
that this short cross shaft actually existed, I had not drilled the holes in the centre longitudinals for the mounting bolts. What I did was to mark out the mounting holes on the solebar and drill them and then clamped the inner boss to the centre longitudinal and, using a long drill, I pushed it through the holes in the outer solebar and used the trunnion clamped in place as a guide to drill the inner holes. If you do not have a drill long enough to do this operation, you merely need to silver solder a No. 43 drill on to the end of a 6" length of $^{1}/_{16}$" diameter rod. I have a number of these lengthened drills in various sizes, some of which are over 12" long. They are usually made to drill inaccessible holes which I have discovered only too late that should have been in there before I assembled something else. The crank on the small cross shaft is connected to the brake linkage by means of a pull rod made out of two flat strips and, if you are fitting the full vacuum brake gear, this is slotted to take the links from the vacuum brake cylinder cross shaft. The link is connected to the first of several links which form the equalising for the brake pull rods. The whole outfit is carried beneath the underframe in a little cradle made up from 6mm × 20 swg strip and offcuts of 16 swg steel plate. The links themselves are all cut from 16 swg steel plate of which offcuts are plentiful from your local sheet metal workshop. The photographs show the sequence of events which I used and, not having found an offcut wide enough to mark the strips straight across, you will see that I had to cut them diagonally along the strip using one as a jig to drill all the rest. The centres of the links are connected with a short link consisting of two collars turned from $^{1}/_{4}$" diameter rod silver soldered on to the ends of a short length of the ever useful $^{3}/_{32}$" mild steel welding rod such that the centres of the small bosses are $^{3}/_{4}$" apart.

Unfortunately, this is as far as I have gone this time since I have had to re-draw the arrangement of the brake gear, but hopefully we can progress a bit further next time.

To be continued.



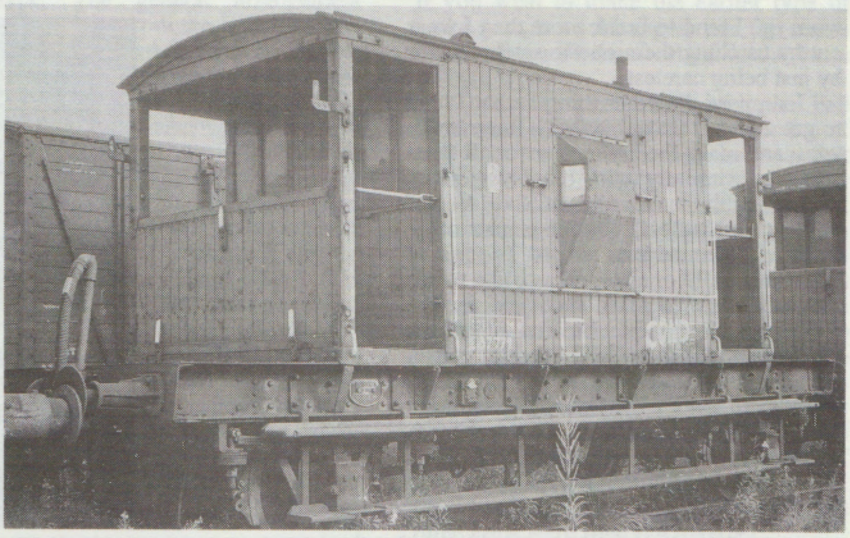
Right: The first stage in making the short cross shafts.



Below: The shafts and cranks ready for final silver soldering.

LNER 20 TON BRAKE VAN

Doug Hewson



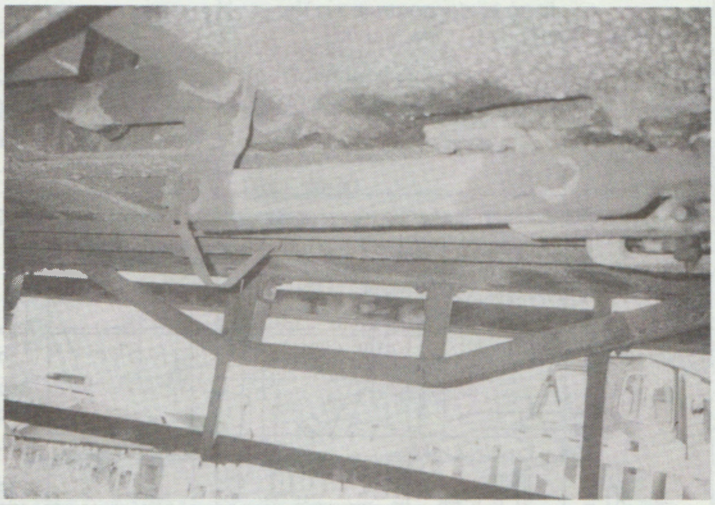
Part Four

Before we start on this month's bits and pieces, I would just like to answer a query which constantly seems to be cropping up. People keep asking me if I have thirty hours in my day and if not, how do I achieve my output in addition to having a full time job? I got to thinking about this whilst in my workshop the other Saturday morning and started analysing what I was doing. The thing is, the production of all these brake gear parts is a job which can be either done with the brain switched off or by making better use of it by thinking of other things whilst drilling holes in bits of metal!

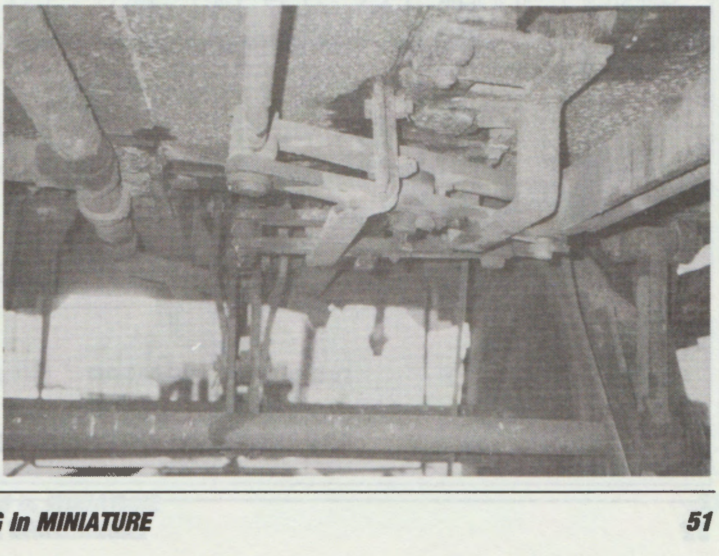
After some considerable thought, it occurred to me that essentially I am primarily a railway modeller and not a model engineer. The biggest difference between us is that my model engineering is not an end in itself, but merely a means to an end. We railway modellers tend to look for short cuts and ways of mass producing little parts which do not entail making special jigs, fixtures, tools and templates to do a job which can be done in ten minutes by simpler means.

Take for instance the axleboxes on this brake van. They are merely pieces of cast iron which require a $^{1}/_{2}$" hole drilled in the back, a slot up each side which can be done with a hacksaw and files, if need be, and a slot across the top for the spring. The way I do my axleboxes is to first run the bottom of the box across the bench grinder to produce a reasonably flat surface and I also take a quick grind across the back of the box to clean off any roughness and flash so that the scribed lines of the axle centre can be seen. Once one box has been marked out, I mount it in the four-jaw chuck with the back outwards, centre drill it and drill it $^{1}/_{2}$". I then face the back of the box with a tipped turning tool and that is the first stage complete. To machine the other three boxes I merely loosen two of the jaws, take the box out, put another one in and give it the same treatment. However, I usually machine about forty axleboxes at one setting and I only check the centre every fourth box or so – it doesn't matter if the centre is a few thou out! To slot the sides of the box I merely use a $^{3}/_{32}$" slitting saw and mount the axle hole on a peg which is fixed into a piece of 1" × $^{3}/_{8}$" bar and clamp the box in a small machine vice on the lathe saddle. It is much easier of course if you have a milling machine, particularly a horizontal one. The box is then spun around so that the other side is uppermost and another slot taken across. This means that the slots are symmetrical about the centre line of the axle hole. On the underside of my little mounting fixture there is a 2BA screw and the height of the box can be adjusted by screwing this in and out, and once the slots are the correct depth for one box, the rest have to be the same. Unfortunately the axleboxes are slightly too tall to fit on my lathe saddle and pass under a cutter to cut the spring slot so, not having a milling machine, I have to resort to using an end mill in the vertical slide for this operation.

Now, there are a number of model engineers of my acquaintance who would delight in spending weeks making jigs and fixtures to hold the boxes to an accuracy of one thou and then try to machine the boxes in twenty six operations. At one of the exhibitions some while ago, a model engineer came up to me and asked why I recommended the use of tipped tools for model engineers as he did not think it was 'proper' for model engineers to use such things as they were for 'industry' and he thought that I should use the old fashioned carbon steel tools. Well, I must admit I do have some carbon steel tools, but heaven knows where they are now! With a tipped tool I can turn wheels and axleboxes without resorting to the use of the back gear on the ML7 lathe. In fact, I not only use tipped tools, but I use the latest throw-away replaceable tipped tools and it is quite surprising how infrequently one has to throw away a worn tip. I tend to break more than I wear



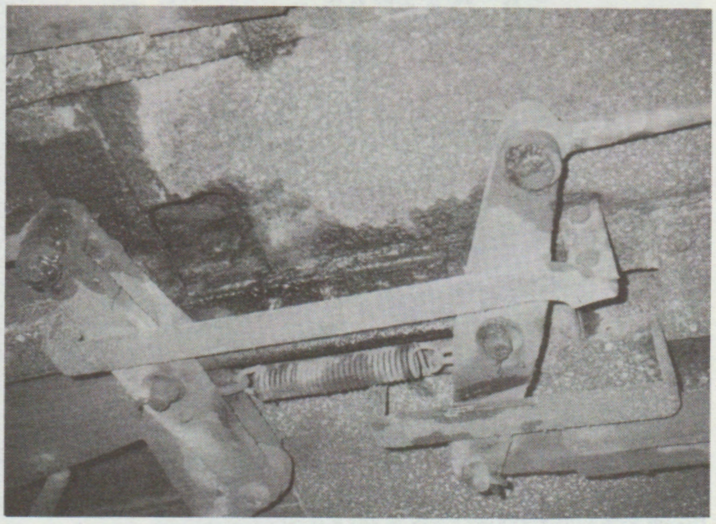
The handbrake cross shaft and connecting links on the piped through van.



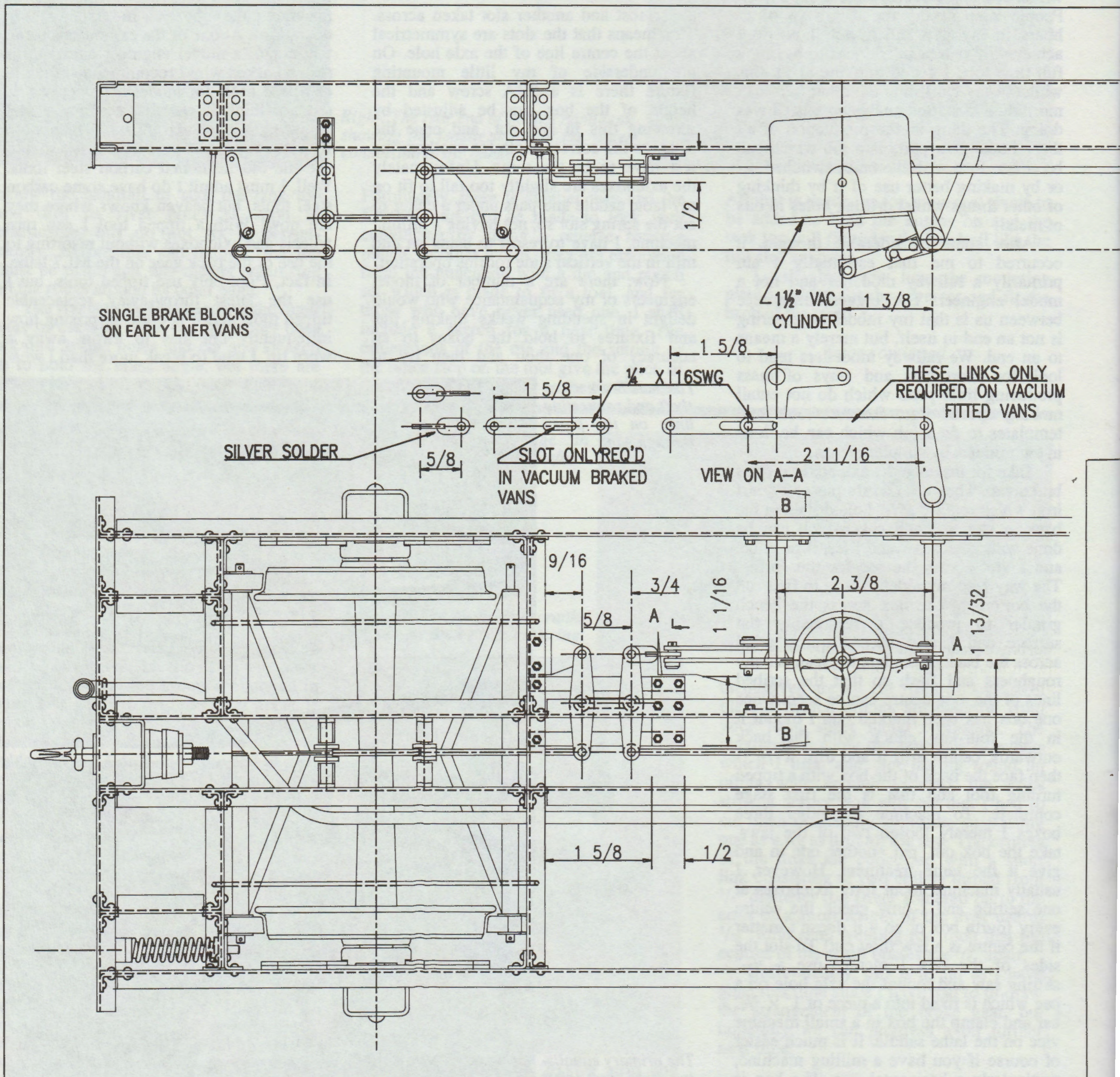
The primary equalising links and safety straps.

worn tip. I tend to break more than I wear out by catching them on the workpiece or by just being careless.

I suppose the other thing is that I tend to get my stall set out, as with these brake vans, and make the brake gear for all three versions. Similarly with other wagons, I will probably make four or five sets of brake gear, buffers, couplings and other assorted ironmongery all at one go. I never just build one wagon as I like to see trains of the things! In fact, just for the record, on the production line at present are these three 20-ton LNER brake vans, a BR Mk 1 second open coach on Commonwealth bogies, two standard Southern 12-ton vans and a Class 20 diesel locomotive, all of which are being built to works drawings. Just for good measure, I am also in the middle of building twenty



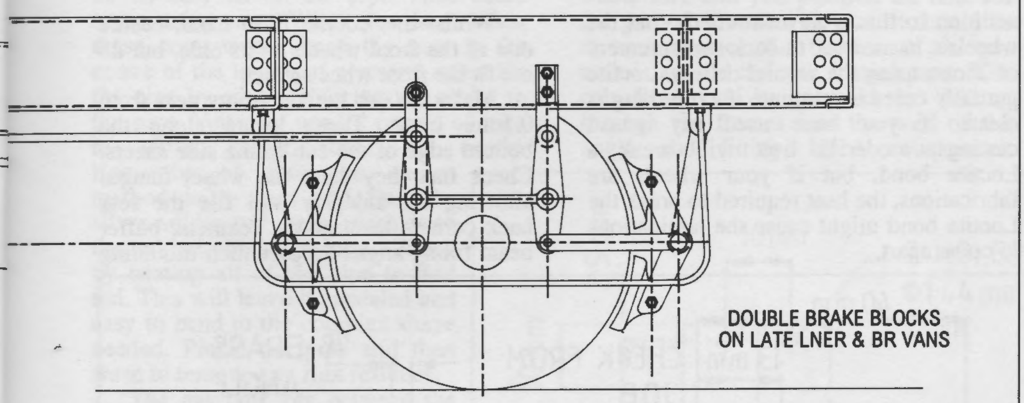
The primary equalising links and supports – note the strong spring which is not shown on the drawing.


SINGLE BRAKE BLOCKS ON EARLY LNER VANS
1/2
1½" VAC CYLINDER
1 3/8
1 5/8
¼" X 16SWG
5/8
THESE LINKS ONLY REQUIRED ON VACUUM FITTED VANS
SILVER SOLDER
5/8
SLOT ONLYREQ'D IN VACUUM BRAKED VANS
2 11/16
VIEW ON A–A
B
9/16
3/4
5/8
A
1 1/16
2 3/8
1 13/32
A
B
1 5/8
1/2

ARRANGEMENT OF BRAKE GEAR FOR VACUUM FITTED VAN more point levers for the sidings on our own railway.

The other thing which saves me hours of time is that on everything I build, I copy the full size vehicle. This way, I don't have to spend weeks planning how to make things differently and trying to re-invent the wheel. One only has to look at the braking systems on model engineering society passenger cars. There must be as many different systems as there are passenger car designs and I am sure that none of them work any better than copying the full size brake gear from a wagon bogie.

The thing is, if you are modelling railway vehicles, they may as well be made exactly like the full size vehicle, and the same goes for locomotives because it not only looks right, but it works correctly as well. If anyone has tried the brakes on one of our standard driving trucks, they will know that they are extremely efficient and only require finger tip pressure to virtually stop dead with a full load of passengers. On these driving trucks, the bogies are quite simply copied from a slightly simplified LNER diamond frame bogie, but the brake gear is an exact copy of the full size wagon and is quite simple to make. It is much, much easier and quicker to merely get on and model what is there in front of your eyes!


DOUBLE BRAKE BLOCKS ON LATE LNER & BR VANS

However, down to some serious business. Since producing the general arrangement drawing for the 20 ton brake vans, I have not been able to find one with the brake gear as shown on that drawing! I have also studied photographs in various wagon books in my possession and, although the pictures in some cases do not show the brake gear very well, they do show enough to indicate that the brake gear is not as I have shown it on the general arrangement drawing. I do know that there are a number of LNER brake vans preserved, though most of the vans in preservation are inevitably of the later type. The general arrangement drawing was done from the LNER wagon diagram which shows that type of brake. All I can think is that it was an early form of brake gear on these vans and the only picture which I can find which vaguely looks like the general arrangement is *A Pictorial Record of LNER Wagons* by Peter Tatlow, and it is plate 350 with a van no. 178705, in which the brake adjuster bar passing under the trusses can just be seen to the left of the nearest wheel. It is interesting to note that this particular brake van also has split spoke wheels.

With the brake gear that I have shown in this issue, it can be seen by following the linkage that no adjustment is ever required other than replacing the brake blocks. The linkage is fully equalised so that every block pulls on to every wheel. If you wish to make the earlier type of brake gear, it would appear that the centre linkage from the hand wheel is the same on both types.

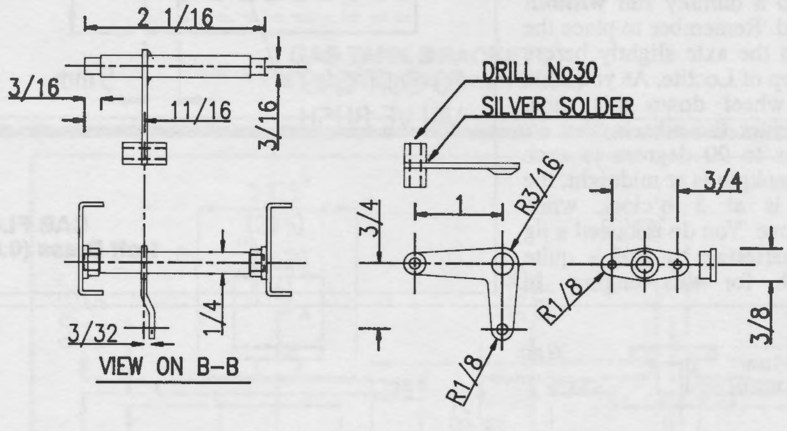
The short cross shaft with the bell crank on it which transfers the direction of pull from the hand wheel to the main link consists of a 2$\frac{1}{2}$" length of $\frac{1}{4}$" diameter round bar turned down to $\frac{3}{16}$" at each end for a length of $\frac{3}{16}$". The crank is cut from a piece of 16 swg steel plate and with the boss on the long arm being the same radius as the end of the crank. The plate has to be left oversize around that end to make silver soldering the boss into the arm easier. I started by marking out the right angle and drilling the three holes No. 30 so that my filing buttons could be used for forming the radius on the end of the short arm and around the pivot point. As I was making three brake vans, all three arms were filed out together.

The little boss is a $\frac{1}{2}$" length of $\frac{1}{4}$" diameter bar with a No. 30 hole drilled through and it is silver soldered into place and then the rest of the long arm can be filed to shape. When you make the arms for your brake van, they will not look quite the same as mine as I made the long arms slightly too long but I am merely moving the position of the hand wheel slightly to suit. The cross shaft is mounted in two small flanged trunnions which are bolted to the solebars and centre longitudinals.

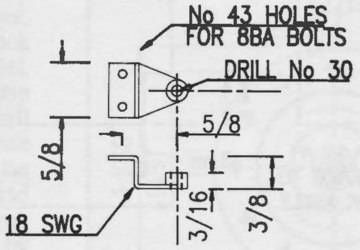
The trunnions merely consist of a $\frac{3}{16}$" length of $\frac{1}{4}$" diameter rod shouldered to fit in a hole in the backing plate, though I made the backing plates first and used the filing buttons to round off the ends and centres. This is another case where I made all six components at once.

Having only just found out recently

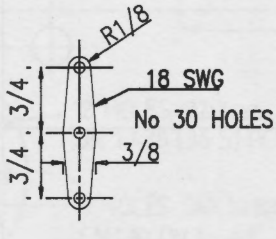
Continued on page 50



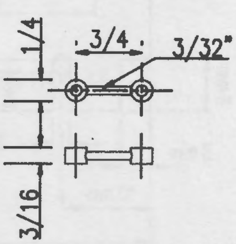
BRAKE WHEEL CROSS SHAFT



EQUALISING LINK TRUNNION



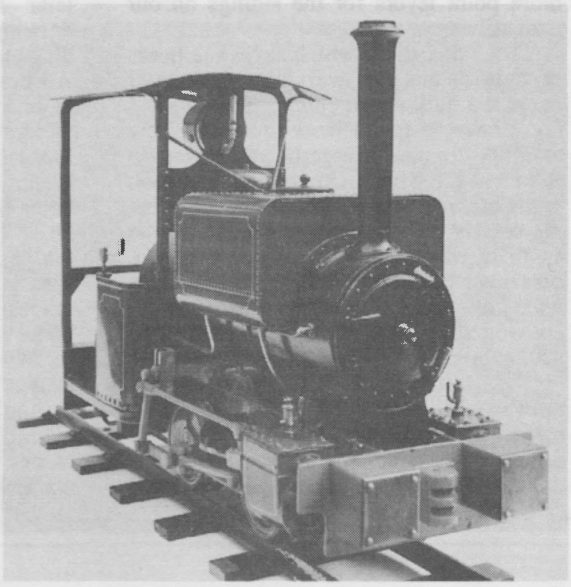
PRIMARY EQUALISING LINK



CONNECTING LINK

THE KERR STUART WREN CLASS 0-4-0 LOCOMOTIVE IN 16mm SCALE

by Malcolm Wright



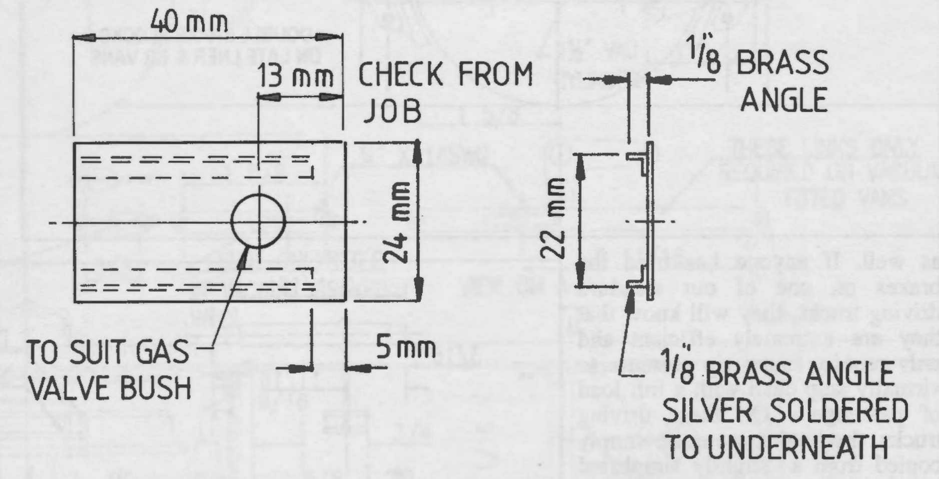
Part Eight

Due to an oversight by the author, in the drawing of the wheel illustrating the June 1997 article (page 378), the dimension of the throw of the crankpin was omitted. This dimension is 6mm which must be identical for all four wheels, hence the need for the jig. I apologise for any confusion caused by this omission.

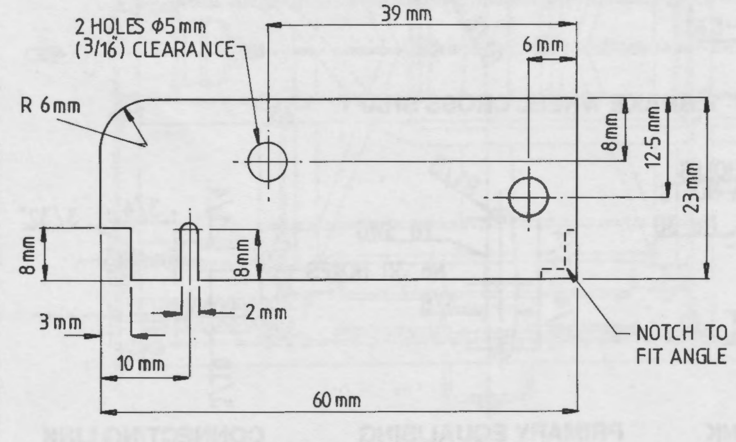
The rear axle set can now be mounted on the engine. Degrease the rear wheels with the long crankpins and the axle. Put a drop of Loctite in the hole, twist the wheel down the axle until the axle is just proud of the wheel face. Give the Loctite ten minutes or so to cure. Clean the back of the wheel with methylated spirits and slide the wheel axle set through the rear axle bearings. It should spin very easily and have no wobble. If it doesn't run easily, re-ream the axle bearings. Set the inside jaws of your vernier caliper to 28mm and lock them. Leaving the vernier caliper close to hand, fit the other wheel. This is one part of building the engine that requires a knack. You are going to have to work quickly, so a dummy run without Loctite is advised. Remember to place the second wheel on the axle slightly before putting in the drop of Loctite. As you slide and twist the wheel down this time, remember to quarter the wheels, that is, set the crankpins to 90 degrees to each other. The left crankpin is at midnight, the right crankpin is at 3 o'clock when looking from above. You do not need a jig – setting the quartering by eye is quite accurate enough for this engine. In addition to this, you must check that the wheelset has a back to back measurement of 28mm using the vernier caliper. Loctite partially cures in a minute if everything is clean. If you have used my wheel castings, moderate heat will break a Loctite bond, but if your wheels are fabrications, the heat required to break the Loctite bond might cause the laminations to come apart.

Whilst the Loctite is to hand, secure one of the front wheels to its axle, but do not fit the front wheelset yet.

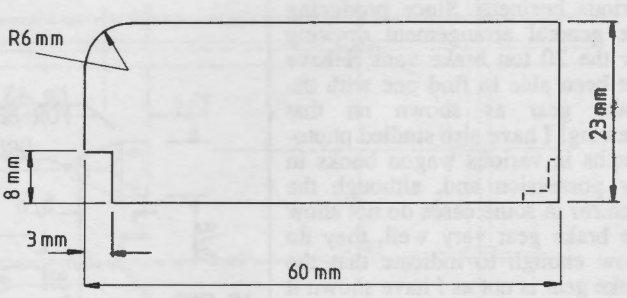
Make the cab bunker floors next from 0.5mm brass. These locate along the bottom edge of the cab frame side sheets. Check that they clear the wheel flanges allowing for sideplay and file the rear back corners to clear the cosmetic buffer beam fixing angle. Prepare their mounting



CAB FLOOR
1 off Brass (0.5mm thick)



LEFT BUNKER FLOOR (Underside)
1 off Brass (0.5mm thick)



RIGHT BUNKER FLOOR (Top side)
1 off Brass (0.5mm thick)

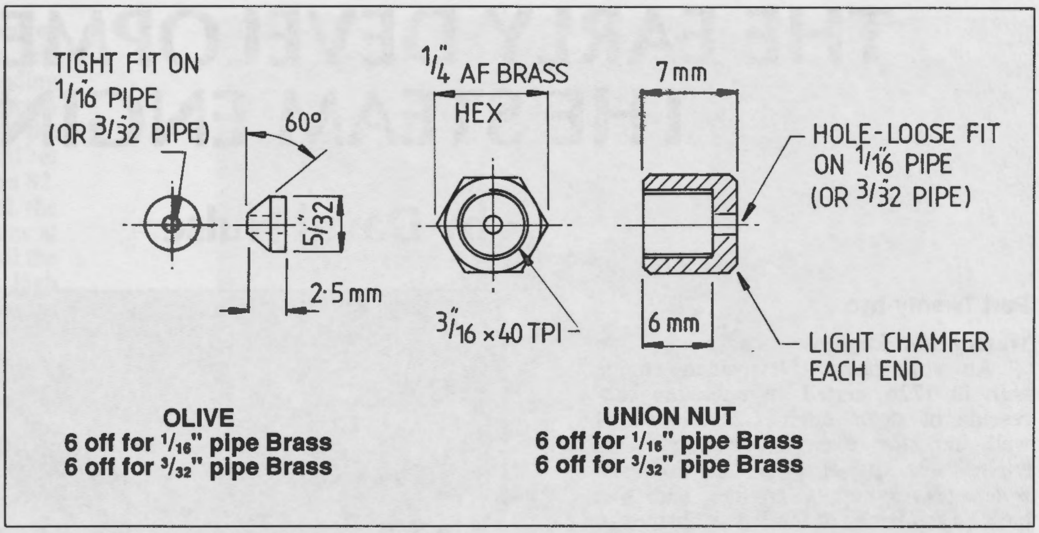
by silver soldering a 1/8" brass angle along the edges that abut the frame and buffer beam. This angle will have to be notched in two places by filing after fixing to the floors. One notch is to clear the cosmetic buffer beam angle and the other, on the left bunker floor only, is to clear the gas pipe running between the gas tank and the gas control valve. Trial assemble the floors to the engine using the datum of the bottom edge of the cab frame side sheet. The frame mounting angle can be drilled and countersunk and two 12BA bolts and nuts used through the frame sides.

The gas pipe is made from 1/16" outside diameter copper pipe. Cut a 125mm length and clean up the ends. Make some pipe olives from 5/32" diameter brass rod, drilling the olives to be an easy fit on the pipe. Also make some union nuts. When you have made these components, keep the nuts in the centre of the length of pipe and assemble the pipe by silver soldering the olives to the pipe. You may need a couple of tries to silver solder them on neatly. Remember, I find the easiest method is to heat and flux the silver solder rod, then touch it to the red hot olive-pipe joint. Finish by heating all of the pipe to dull red. This will leave it annealed and easy to bend to the complex shape needed. Pickle the pipe and then wash to remove any flux residues.

The gas tank fits between the frames at the rear of the locomotive. It is retained by a 'U' shaped bracket folded from 1mm thick brass strip and a small plate bolted to the underside of the rear frame spacer. The bracket is held between the frames with 12BA hexagon headed bolts and solder paint. The tank is prevented from moving fore and aft by the cab floor which is a simple fabrication made from brass plate and 1/8" brass angle. Make sure that you position the hole for the gas valve bush with care. It should be in such a place that the rear of the gas tank is against the rear frame spacer. The cab floor can be retained by drilling through the frames into the web of the angle and fitting 12BA countersunk screws and nuts, or by soldering with solder paint.

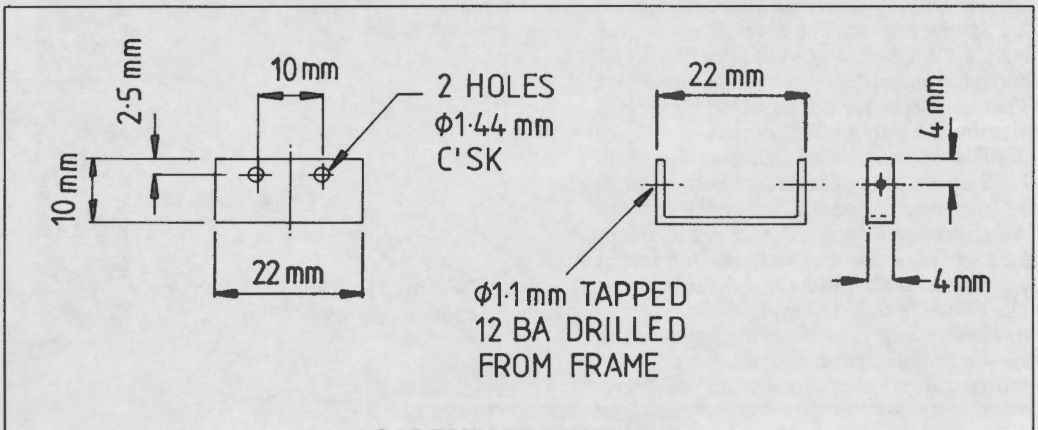
Next time we shall finish fitting the gas tank, construct the Hackworth bearings and shaft, fit the gas pipe and make the gas control valve.

To be continued.



OLIVE
6 off for 1/16" pipe Brass
6 off for 3/32" pipe Brass

UNION NUT
6 off for 1/16" pipe Brass
6 off for 3/32" pipe Brass



GAS TANK BRACKETS
1 off each Brass (1mm thick)

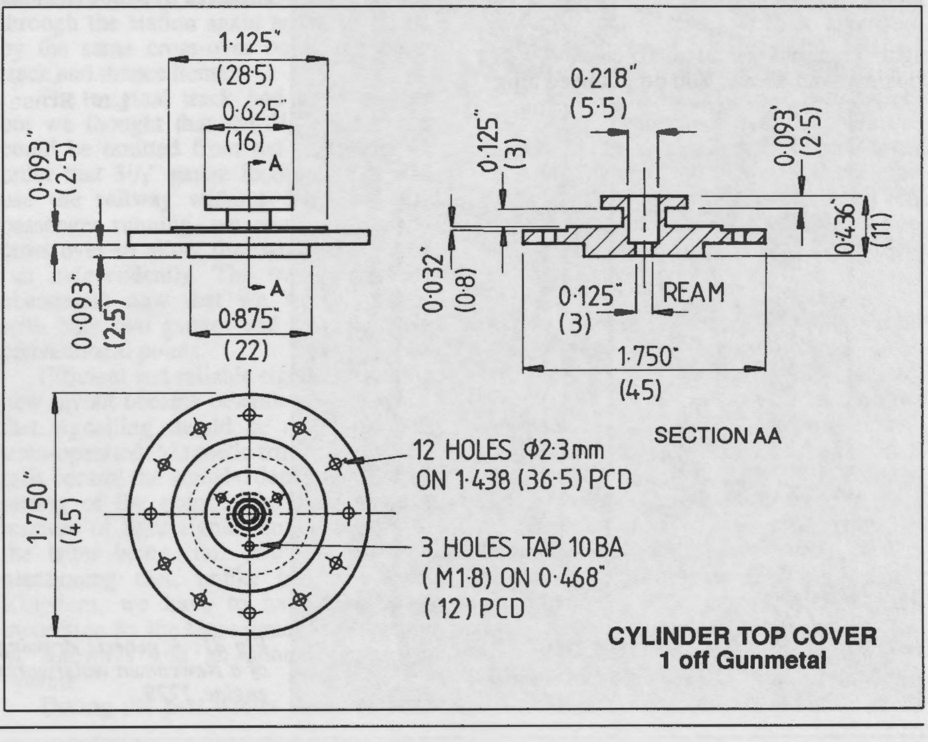
REULEAUX'S TRAPEZIUM CONNECTING ROD ENGINE

Continued from page 38

clearance hole, countersinking on the underside. Also drill and tap 8BA for the fixing studs. Drill and tap the bottom of the frame to take a countersunk screw. Screw the foot to the frame – this will hold things in place while the two parts are silver soldered together. Clean up all round and the guide frames are complete.

As a gunmetal casting the cylinder top cover is supplied with a chucking spigot. Hold the casting in the four-jaw chuck spigot outwards and clean it up parallel. Change to the three-jaw chuck and grip by the spigot. Face, centre drill, drill through, ream and counterbore. Machine all the top faces and the edge. Transfer the chuck with the work to the dividing head and drill the stud holes. Cut off the spigot. Machine soft jaws to hold the casting by the outside edge and face the underside forming the locating boss at the same time.

To be continued.



CYLINDER TOP COVER
1 off Gunmetal

THE EARLY DEVELOPMENT OF THE STEAM ENGINE

by David Hulse

Part Twenty-two

Waterworks Engines

An atmospheric Newcomen engine built in 1726 started an unbroken succession of steam engines that extended well into the twentieth century. This engine was the first of the domestic waterworks pumping engines and was built on the banks of the River Thames to pump water for distribution throughout London.

The London Waterworks, known as the York Buildings Waterworks, was established in 1676 and was situated at the lower end of Villiers Street, Strand. Captain Savery installed one of his engines at these waterworks, but without great success. When the Newcomen engine was installed, it stood alongside the Savery engine. The Newcomen engine had a large brass cylinder of 35$^1/_2$" diameter and lifted water from the River Thames for storage in a reservoir before distribution throughout London.

The engine, figure 80, was drawn in 1725 by Sutton Nicholls and is thought to be the engine assembled at the York Waterworks. Prints of this well documented engraving were offered for sale at a price of one shilling by John King at The Globe in the Poultry, London.

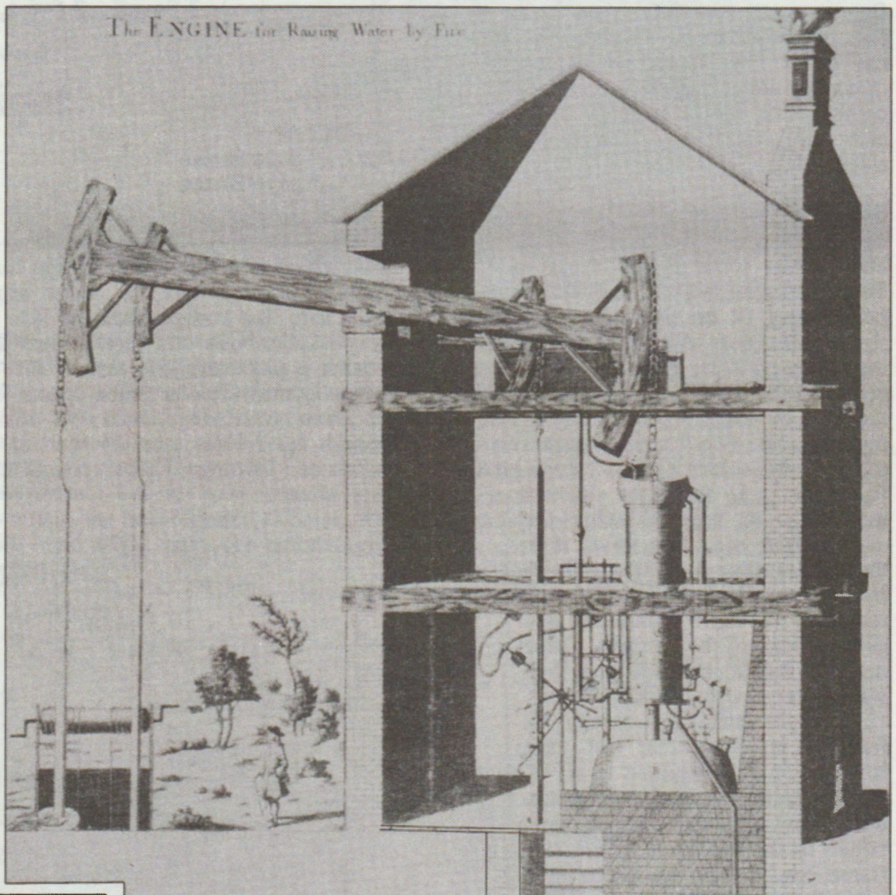

The ENGINE for Raising Water by Fire

Fig 80: The Newcomen waterworks engine at York Buildings, drawn and engraved by Sutton Nicholls in 1725.

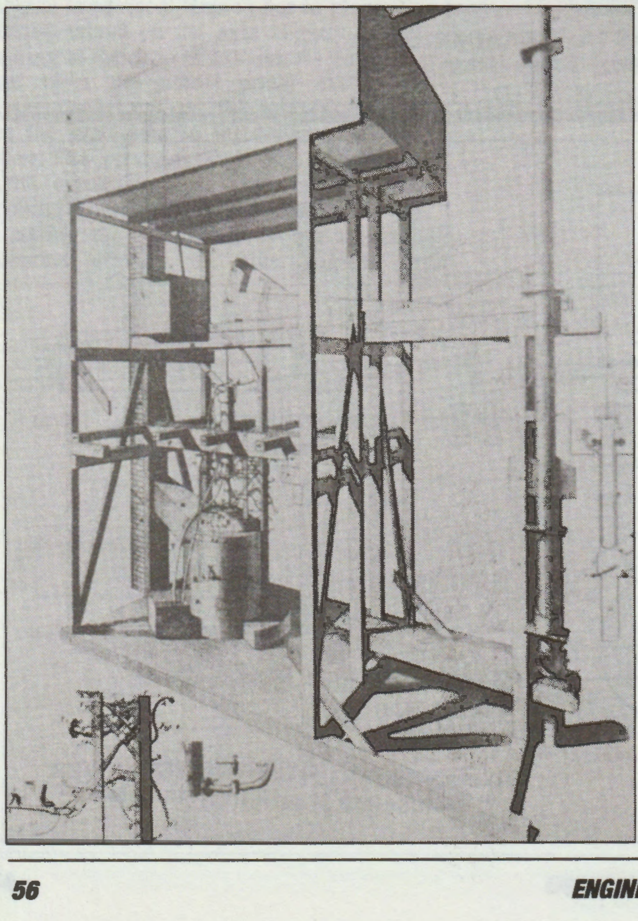


Fig 81: A generic drawing of a Newcomen waterworks engine, 1729.

The stately dressed gentleman viewing the country scene had been shown on all the illustrations of Newcomen engines until this date. He was shown for the first time on the drawing of the Griff engine that was drawn by Henry Beighton some eight years before. Beighton set a standard way of illustrating these early Newcomen engines, with the figure being used to give a sense of scale.

The only difference between many of the early steam engine pumping installations was the physical size of the engine and its ability to lift water from mine workings or for domestic use. Another illustration of a similar, though lighter, Newcomen waterworks engine is shown as figure 81.

From the original Newcomen waterworks engine built in 1726, there evolved some of the largest and most powerful steam engines ever to be made. The engines were often floridly and colourfully decorated with much attention to aesthetic detail, the builders even applying gold leaf to many of the structural supports of the building and engine castings. In many counties, the pride in the municipal waterworks showed itself in the pumping engines' ornate buildings, which have been described as 'cathedrals of steam power.' Only a few of these superb buildings are still standing today. One of these magnificent steam pumping stations was built by the Staffordshire Potteries Water Board at Hatton in 1890 and is shown in figure 82. Engines continued to be built until the early 1920s, being powered by steam at very high pressure and were used until the early 1960s, only succumbing to high powered submersible electric pumps which were much cheaper to run.

To be continued.

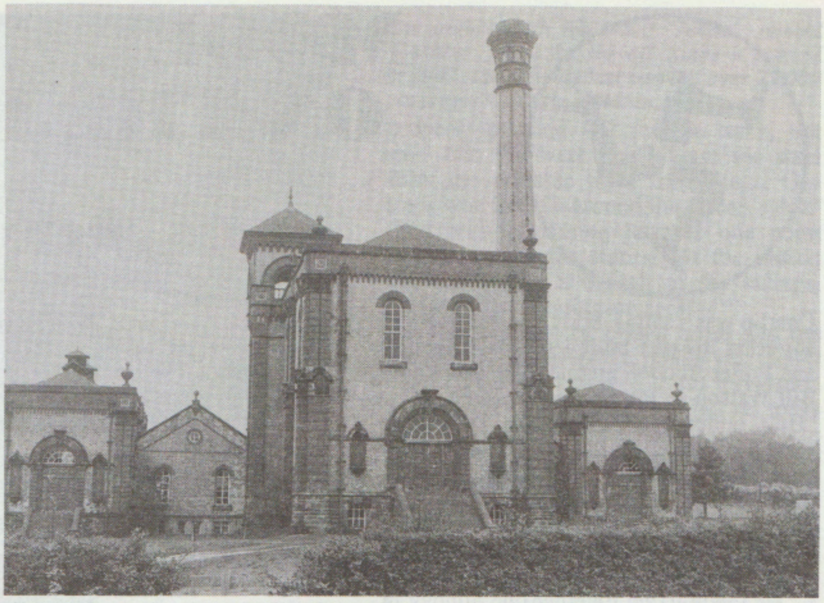
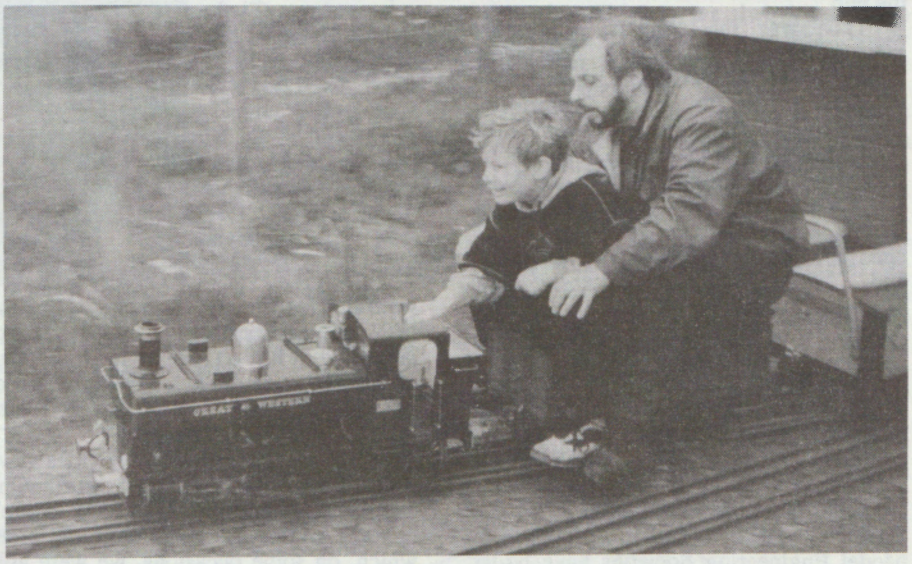


Fig 82: Staffordshire Potteries Waterworks 1890 pumping station engine house at Hatton.

MODEL ENGINEERING ON THE ISLE OF MAN

Continued from page 59



The club's youngest member under instruction from his dad. Junior members, of course, are not permitted to take passengers.

raise enough finance for us to do what we wanted.

By May 1992 we were ready to run and the Chief Minister of the Isle of Man (our prime minister) came to declare the line open. We called it 'the Orchid Line' from the wild orchids growing in the field.

After a successful season, we had generated enough money to carry out maintenance, make some minor improvements and begin paying back the debentures. The small group of members who did not want to carry passengers gradually dropped out.

The winter of 1992/93 was devoted to consolidation and making more improvements. 1993 was an even better season and we decided to build a proper carriage shed as well as extending the engine shed at the back. By the end of the 1994 season we were able to repay half our debt and felt ready to spread our wings.

We started a dialogue with the park authorities as to where the railway might expand. There were a number of quite attractive options, some of which would have proved extremely taxing on our available manpower. Some were, from our point of view, practical but involved cutting through animal enclosures which made them unacceptable.

Eventually a route was agreed which did not disturb any of the park's plans and which was realistic from our point of view. It involved two stages which could be carried out over the two succeeding winters and work commenced in October 1995.

Phase I consisted of putting an outer ring around the existing track. To make it more interesting, the outer circle actually left the Noah's Ark field by a bridge over a stream and through a hedge. It then returned to the field via another bridge 40 yards further on. Trains would start at the station on the outer circle, pass via a cross-over on to the inner track, stay on the inner circle until they had passed through the station again and then return by the same cross-over on to the outer track and thence home.

The original track had three gauges but we thought that the $3^{1}/_{2}$" gauge rail could be omitted from the extension. In order that $3^{1}/_{2}$" gauge locomotives could use the railway without disturbing the passenger running, we could switch the cross-over to allow the two circles to be run independently. The traversers were abandoned now that we were working with only two gauges and we could use conventional points.

Efficient and reliable signalling for the new layout became essential. We decided that signalling should be automatic and train-operated. Magnetic trips between the rails control the signals, depending on the setting of the points. The signals are a mixture of light signals and semaphores, the latter being 'fail safe'. It is worth mentioning that, unlike in the United Kingdom, we have to have an annual inspection by the Government's Inspector of Railways and an annual permit to operate.

During the past winter we have been completing Phase II of the extension. This involved breaking into the outer circle and taking the line in a 'figure of eight' around the adjoining field. We had to cross a pond by building a steel bridge and we also had to cross a path twice. Previously, where we had to cross the path to the Noah's Ark, we had built level crossing gates controlled from the station. The new crossings, however, were no longer in view from the station and so we have installed flashing light signals controlled by the train.

Over the years, our stock of locomotives has increased. A $7^{1}/_{4}$" gauge 'Jessie' and a 5" gauge 'Sweet Pea' arrived during 1992 and in 1994 a $7^{1}/_{4}$" gauge GWR pannier tank locomotive arrived. In 1996 a $7^{1}/_{4}$" gauge 'Koppel' was completed by our chairman and a new member finished his $3^{1}/_{2}$" gauge Stanier 4P 2-6-4 tank locomotive.

And what of the small group of members who did not want to be involved in public running and had left the club? They formed their own society and built a track in the south of the island in a pleasant site with permission from a local farmer. We wish them well.

MODEL ENGINEERING ON THE ISLE OF MAN

Denys Drower

The two original locomotives on duty on a Sunday. The left hand locomotive, a 5" gauge Simplex, is on the original track, while the Manx locomotive, driven by builder Mike Casey, is on the outer circuit. The track on the right leads to the steaming bays.

Charlie was visiting Eddy's workshop and admiring his part-built $1^1/_2$" scale Aveling and Porter traction engine. "Do you know Bill Watson in Bury Street?" asked Eddy. "He's building a $3^1/_2$" gauge Tich; then there's a friend of his in the same firm who has a 5" gauge track and has built a Simplex."

"There's a bloke down this road named Ellis who has built a Stuart Turner triple," Charlie countered. Then a thought – "We ought to get together one Sunday in the pub."

Thus was the nucleus of another model engineering society conceived. Soon a group of model engineers were meeting in 'The Bell' every Sunday and somebody volunteered to become the 'hon. sec.' and so a model engineering society was born on the Isle of Man. There was a false start some twenty years ago when the new club fizzled out, but the need and the ingredients were still there and the regular pub get-togethers gradually resumed.

In 1985, the question of forming a club arose once again. There were those who felt things were alright as they were – no formality, no committee, no AGM, etc, while others thought that a club would have advantages and it was one such advantage which tipped the balance. Both the Northern Association of Model Engineers and the Southern Federation of Model Engineering Societies have boiler inspection and insurance schemes which are of immense value to the model engineer, particularly if he has a model locomotive or traction engine.

We already had a natural leader within the group who was voted in as chairman, a local vicar who was a steam enthusiast volunteered to become the secretary and someone else was elected treasurer and so was born the **Manx Steam and Model Engineering Club**. The reason the word 'steam' was put into the title was that we were not just interested in models; some of the prospective members were interested in full size steam launches, two of which were already on the island. There were also one or two full size traction engines on the island.

As it turned out, our activities have concentrated on the small stuff. One member had a fine $4^1/_2$" scale Burrell traction engine in good working order which, on some occasions, we were able to take to fetes and similar events. He also had two good passenger-carrying trucks for the engine to tow.

There were two 5" locomotives owned by club members – a Simplex 0-6-0 locomotive and a prize-winning 5" gauge model of an Isle of Man Railway 2-4-0 tank locomotive. There were also a few $3^1/_2$" gauge locomotives which had been donated to the club by an elderly enthusiast just before he died. A friend from England had given us the bits and pieces to make up at least two $7^1/_4$" gauge passenger trucks, so we began to think about constructing a track.

It was decided that we should have a portable track of three gauges about a 120 ft long. It was to be made of steel bar and, so that it could be transported, it was to be built in 10 ft lengths ready to be bolted together on site. We also constructed a four-wheeled trailer.

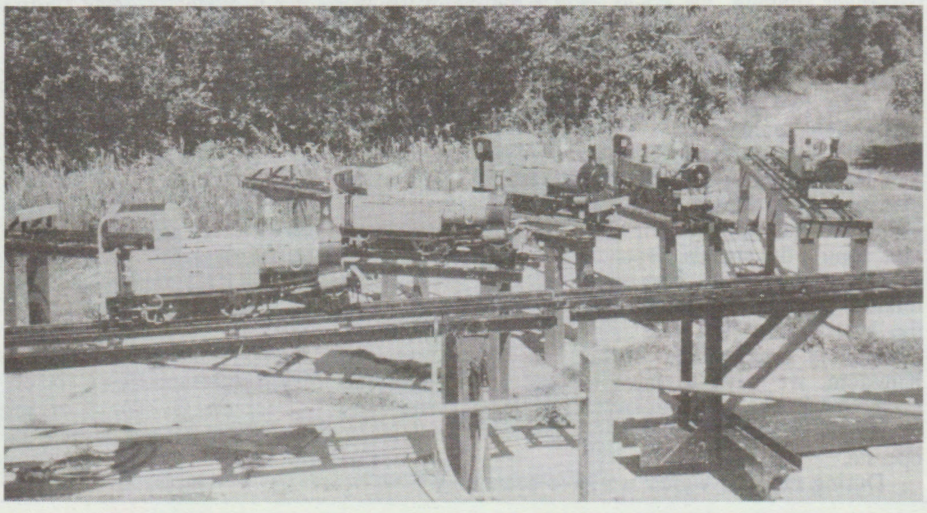
Visiting local events and giving rides to the public gave ourselves some experience whenever a fair or fete had level ground with a suitable space. We charged a small fare to cover our costs and to start the nucleus of a club fund which could then be used when we could achieve something more permanent.

By 1990 we had begun to think seriously about finding somewhere where we could build a permanent circular track.

There were a number of considerations to be taken into account, such as reasonable security of tenure, protection from vandalism, car parking and the possibility of carrying passengers.

This last consideration was not to the taste of all our members. One or two wanted the railway to be for our own exclusive use. However, most of the members took the view that, by taking fare-paying passengers, we would amass enough money to build a better and bigger railway. Anyway, we felt there was little fun in just chuffing around by ourselves.

To buy our own field was soon found to be out of the question. The land had to be level and the only plots which were



The turntable and steaming bays during the Manx Electric Railway centenary celebrations when there were five 5" gauge Isle of Man Railway model locomotives on the island at one time.

The author with his 0-4-0 'Jessie', named 'Cushag', waits for the off. Since it opened in 1992, the railway has carried over 22,000 passengers, mostly children.

anywhere within reach of our meagre resources were small, uneven, sloping and inaccessible. To rely on the goodwill of some well-disposed friend also posed considerable problems.

That left a public park or somewhere similar. The chances were that we could negotiate a good period of tenure and there would almost certainly be parking facilities. But what about vandalism? There was not much chance of avoiding that, even in the Isle of Man.

There was, however, one option which seemed promising – the local wildlife park. A zoo is about as secure as it could be. For one thing, because animals have to be fed and watered, there are always staff about except at night when the gates are locked up. The fact that animals must be kept secure with strong fencing means that vandals cannot easily get in. Anyway, it was out in the country.

The wildlife park also had the advantage of being flat, having a large car park, toilets and a café. There would also be a steady stream of visitors during the tourist season who would love to have a ride on a steam train.

The authorities, seeing the possibility of an added attraction to help increase the number of visitors, were quite helpful although slightly wary that this might be bringing a fairground element into the park which could detract from its true purpose. They allocated a very suitable field which was level and had a small lake in the middle of it with a building shaped like Noah's Ark in which there were terrapins, tortoises and other small mammals.

In return, the park authorities wanted us to run on weekends throughout the season. This was quite impossible as we did not have the manpower and it would have worn out the two engines within a very short time. However, we guaranteed that we would try to run every other Sunday during the season. The rental was fixed and work started that winter.

The wildlife park is in an area known as 'The Curraghs' – the Celtic word for marshland. Over the years it had been drained and the resulting pasture was fertile and reasonably firm. The water table, however, was only 12" or so down as we discovered when we began to dig out the foundations of the track. One of our members suggested the use of 'Terram', a thin fibreglass underlay used in building. This proved ideal for the job. We dug out the ground to a depth of about 6", laid the Terram in the ditch and filled it with ballast until it was about 3" above the level of the land. For ballast we used road chippings which the local highway authority had swept off the roads after they had been re-surfaced. These chippings suited us very well, being about the size of peas. This system proved completely satisfactory and, after five years, the track has hardly sunk into the soft underlying soil at all.

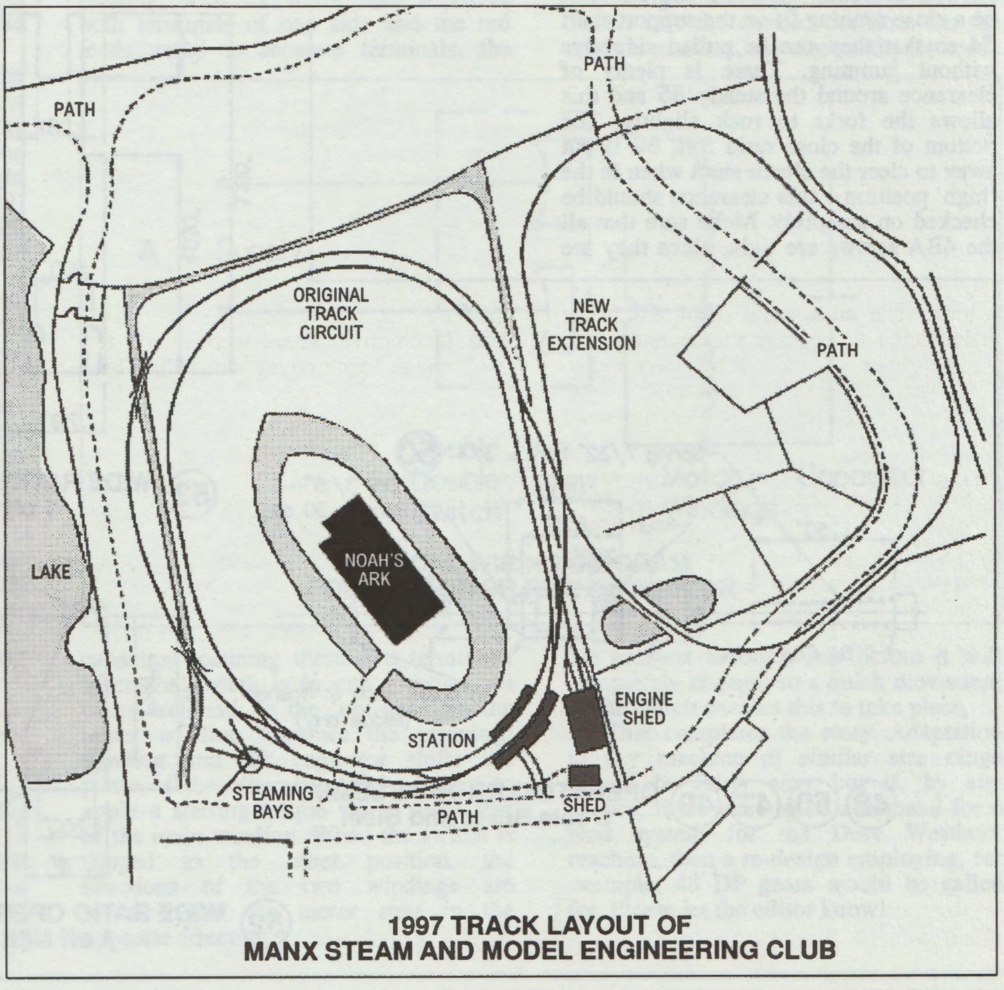
We decided that we should opt for properly profiled rail for the track, not steel bar. We were able to use the steel from the portable track for sidings. Our track was a circle around the 'Noah's Ark' field with a passing loop at one point which became the station. At the station there was also a branch to the sidings, leading to a steaming-up area.

The question of points arose and the prospect of triple gauge points was rather daunting, so we resolved to try traversers. A traverser had to be firmly set on to its own rails and had to slide exactly into place when moved. To work them, we used car window motors which proved to be sufficiently powerful, being controlled from a box at the station. In practice, they worked well until a spell of hot weather when expansion caused them to jam. However much we greased the fish plates of nearby rail joints, we always seemed to have trouble in high summer. The remedy was to use a watering can to cool the traversers down!

One of our members is an accomplished joiner and he set about building us an excellent engine shed close to the station. At the other end of the sidings, we built a raised steaming-up complex with five radiating branches and a turntable.

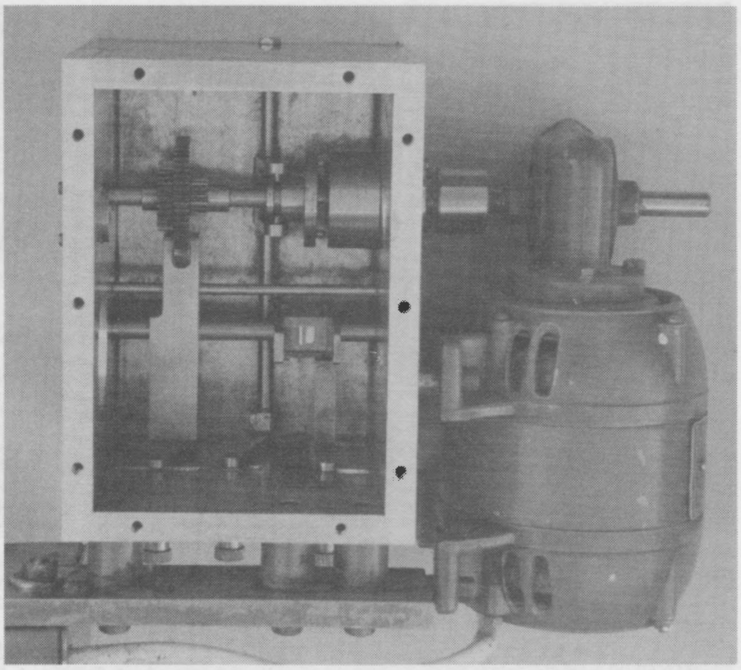
To finance all this expenditure, we invited the club membership to purchase debentures. These carried no interest, they were merely a loan, but the members responded generously and we were able to

Continued on page 57



1997 TRACK LAYOUT OF MANX STEAM AND MODEL ENGINEERING CLUB

A POWER FEED GEARBOX FOR A MILLING MACHINE



D A G Brown

discusses the operating gear and final details for this useful piece of equipment he made and fitted to his Myford VMC milling machine

Part Six – Conclusion

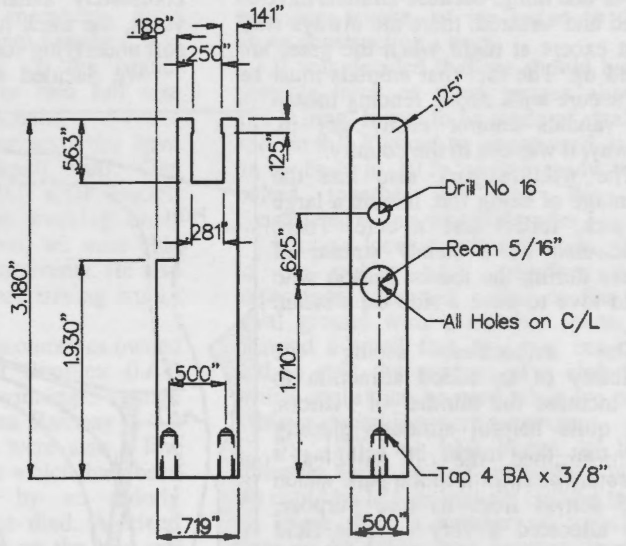
The final group of components to be made for the gearbox includes the operating levers. We have already dealt with the clutch lever in the previous section, but this needs one of the operating knobs 47 with its screws 48 and springs 50, not forgetting the single washer 49 for the centre assembly alone. On the final assembly of all three units, the threads should either be suitably deformed or Loctited to secure the screws in position so that they lie flush with the ends of the levers.

The operating forks 53 and 59 must be a close running fit on the support shaft 54 so that they can be pulled sideways without jamming. There is plenty of clearance around the steady 55 and this allows the forks to rock slightly. The bottom of the close ratio fork 59 is cut away to clear the clutch shaft when in the 'high' position – this clearance should be checked on assembly. Make sure that all the 4BA screws are tight, since they are inaccessible when the gears are assembled above them.

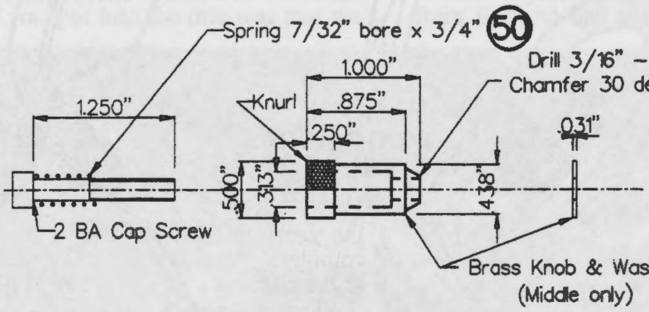
GENERAL ASSEMBLY

No details are given of the motor mounting, but this should be determined at this stage, remembering that blind mounting holes in the right hand plate 4 avoid oil leaks. A plain coupling is recommended between the motor unit output shaft and the input clutch shaft 12 but, to avoid strain, do make sure that the alignment is accurate.

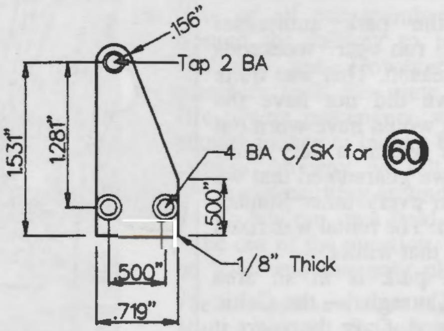
When fixing the cantilever bracket to the gearbox by means of three 5/16" BSF screws, three spacers are necessary to set



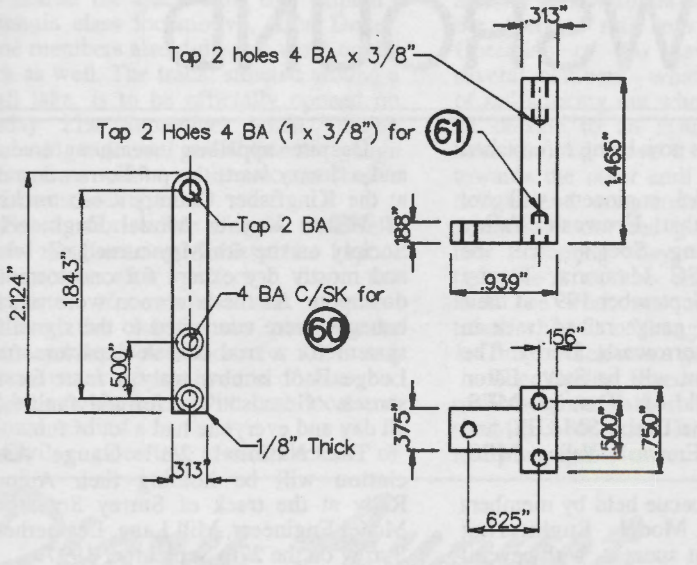
(53) **WIDE RATIO OPERATING FORK**
1 off Brass


Spring 7/32" bore x 3/4" (50)
Drill 3/16" – Chamfer 30 deg
1.000"
1.250"
Knurl
.875"
.250"
.031"
.500"
.313"
.438"
2 BA Cap Screw
Brass Knob & Washer (Middle only)

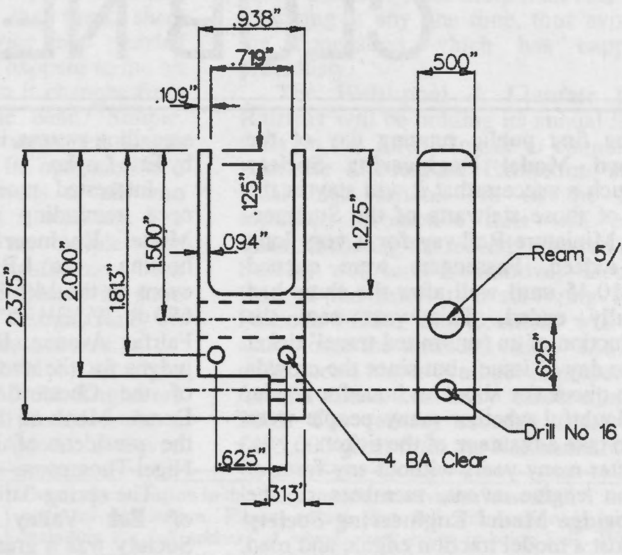
(48) (50) (47) (49) **OPERATING KNOB ASSEMBLY**
3 sets Brass and Steel



(52) **WIDE RATIO OPERATING LEVER**
1 off Mild Steel



57 58 **CLOSE RATIO OPERATING LEVER & BLOCK**
1 off each Mild Steel



59 **CLOSE RATIO OPERATING FORK**
1 off Brass

over the box to the correct centre line. Do not guess their length, but measure the offset with a depth gauge or vernier caliper and make the spacers accordingly.

Bearing in mind what has been mentioned about sealing the joints during the final assembly, the three operating levers and associated equipment are the first units to be fixed in place. Well oiled, make sure that they all work freely, but do not finally fix the operating knob screw 48 into the close ratio operating lever, since a small shim will be required to stop any oil spillage.

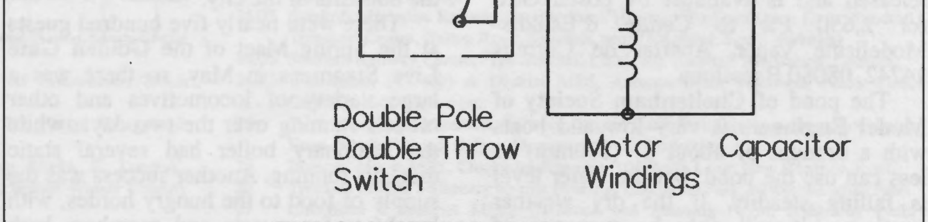
Insert the gear sets and shafts in the order: input shaft, layshaft and output shaft, making sure that all of the Woodruff keys slide freely. Fill the gearbox with a medium viscosity straight mineral oil (for example Shell Vitrea 32) to the level where the 112 tooth gear 28 on the output shaft is just touching the surface. When the gearbox is running at the highest speed, this gear will tend to throw oil at the back of the front plate 3. If unrestrained, the oil will leak out through the slot in the front plate. To overcome this problem, fit a 0.005" brass shim just behind the front plate, under the right hand screw 48. The shim will then move left and right with the close ratio assembly and always be behind the large wheel, catching all that is thrown at it.

The gearbox can now be fitted on to the end of the leadscrew without any clamp screw required associated with its key. End movement is restrained by the positioning of the cantilever bracket 62 on the table stop dovetail or tee slot.

ELECTRICAL INSTALLATION AND OPERATION

From the photographs already published, a small box can be seen fixed to the front of the cantilever bracket 62. This houses both the motor capacitor out of harm's way and also a reversing switch with a centre off position. The switch is of the double pole double throw type, arranged to move horizontally in such a way that its sense coincides with the direction of the table travel.

Easily the most common and most suitable type of mains motor is the capacitor run design, in which two equal windings are brought out of the motor with three wires, usually one black and two red. The connection diagram below shows how to arrange for reversible running, with the black lead wired to both terminals of one side and the red leads wired to separate terminals, the capacitor spanning these two terminals; when the switch is in mid position, all wires are dead. In the 'up' position, the upper winding becomes the 'running' winding and the capacitor shifts the phase of the other 'starting' winding to apply a starting torque which leads that of the main winding. When the switch is flipped to the other position, the functions of the two windings are reversed and the motor runs in the opposite direction.



TYPICAL WIRING DIAGRAM FOR CAPACITOR RUN A.C. MOTOR

Rapid manual traversing of the table is performed with the close ratio gears in one of the two neutral positions, so that only the output cluster rotates. Get a feel for the likely feed value for any job being undertaken, then turn on the motor, engage the dog clutch and slide the wide ratio lever into the desired position, grasping the operating knob firmly and perhaps giving a slight helping torque to the operating knob assembly. Then pull out the right knob and ease the close ratio cluster into the desired position. On the original gearbox, the close ratio set needs the gearbox to be at rest before it will completely engage, so a quick movement of the clutch enables this to take place.

That completes the story. Adaptation to any machine of similar size range should be fairly easy but if, by any chance, there were to be a demand for a feed system for the Dore Westbury machine, then a re-design employing, for example, 48 DP gears would be called for. Please let the editor know!

CLUB NEWSROUND

The first public running day of the **Bedford Model Engineering Society** was such a success that it will stay in the mind of those stalwarts of the Summerfields Miniature Railway for a very long time indeed. Passengers were queued from 10.45 until well after the show had officially ended. This year saw the introduction of an 'unlimited travel' ticket (on the day of issue), but since the crowds had to queue for about an hour for a ride, it is doubtful whether many people were able to take advantage of the ticket.

After many years without any form of traction engine event, members of the **Cambridge Model Engineering Society** will host a model traction engine and road vehicle rally on Sunday 21st September at their site at Fulbrooke Road, off Grantchester Road, Cambridge. If you own a traction engine or any other type of steam road vehicle, then make a note of this date. Further information is available from the secretary, telephone (01223) 840125.

The **Centre de la Mine et du Chemin de Fer** is organising a Model Steam Day on Sunday 31st August 1997. The centre, in the 'Centre Denis Papin', rue Emile Zola, is situated in Oignies, France, which is 15 miles south of Lille and easily reached by motorway from Calais in about an hour. The centre has a 5"/7¼" gauge ground level track, a pool for boats, interior and exterior areas for road vehicles, two interior 45mm gauge layouts and exhibition rooms with tables for static exhibits.

The popularity of steam locomotives gets even greater with the **Centre d'Estudis-Modelisme Vapor** at the Correu de l'Oreneta in Barcelona, Spain, Members held their thirteenth 24 hour steam run at their 5"/7¼" gauge track on 31st May/1st June, while the club's activities can be found on teletext on Barcelona television. A 39 minute video, 'El Tren de l'Oreneta', about the railway and its enlargement in 1994 has also been released and is available by postal Giro for 2,650 Pts to Centre d'Estudis-Modelisme Vapor, Apartat de Correus 14242, 08080 Barcelona.

The pond of **Cheltenham Society of Model Engineers** is very low and boats with a draught of about 8" (200mm) or less can use the pond, but the water level is falling steadily. If the dry weather continues, it will only be a matter of weeks before the pond becomes unusable, despite the rain during early May.

The flexible traverser track of **Durban Society of Model Engineers** has been realigned by alteration to the stops to provide a smooth transition of trains. New fully adjustable bolt hole brackets have been installed after the traverser tracks were corrected and re-bedded. The 32mm diameter pneumatic cylinders, with microswitch position indicators, have been fitted to the locking bolts, though a facility for manual operation has been retained. The requisite signalling and warning system, which will be independent of the main signalling system, is now being refurbished by Eric Lupke.

Interested model engineers will not need reminding that **Erewash Valley Model Engineering Society** will be hosting the LBSC Memorial Trophy event on the 14th September 1997 at their 680 ft 2½"/3½"/5" gauge raised track in Fairfax Avenue, Borrowash, Derby. The judges for the event will be Steve Eaton of the Chesterfield & District MES, Dennis Monk of the Derby SM&EE, and the president of Erewash Valley MES, Nigel Thompson.

The spring barbecue held by members of **Esk Valley Model Engineering Society** was a great success, with several local Scottish clubs attending. Members had been busy all winter adding a turntable and steaming bays to their 2,200 ft ground level 3½"/5"/7¼" gauge track at Vogrie Country Park, near Dalkeith, Scotland. Vehicle access to the steaming bays has also been improved. Visiting locomotives are always welcome, but do check first by contacting the secretary, Peter Fretwell, on 01721 72103 or the president, Geoff Thrower, on 01875 822388.

Large heaps of soil were dumped around the track of **Fylde Society of Model Engineers** recently and has now been spread out to raise the general level of the grassed area so that the track is not quite so high, especially on the top bend.

The grand opening of the Broomy Hill Railway, built by members of the **Hereford Society of Model Engineers,** will take place at 2.00pm on Sunday 31st August 1997. The opening ceremony will be performed by the Mayor of Hereford, Councillor Tudge, who is an active member of the 6000 Locomotive Association. There is a 900 ft 5"/7¼" gauge ground level track and a raised 3½"/5" gauge line of 800 ft on the site adjacent to the Broomy Hill Waterworks Museum on the outskirts of the city.

There were nearly five hundred guests at the Spring Meet of the **Golden Gate Live Steamers** in May, so there was a large variety of locomotives and other models running over the two days, while the stationary boiler had several static displays running. Another success was the supply of food to the hungry hordes, with breakfast for guests and members both days, over 225 hot dogs supplied for lunch and 63 people at the catered dinner!

After a rally at the Cambridge Model Engineering Society's tracksite in July, members of the **Maxitrak Owners Club** have been invited to hold a rally on Sunday 3rd August 1997 at the tracksite of the Surrey Society of Model Engineers at Mill Lane, Leatherhead, Surrey. Facilities include 5" and 7¼" gauge tracks as well as a grassed area to run traction engines, etc. Everyone is welcome, even if you are not a Maxitrak owner. Further details of this event are available from Mr E Penn, telephone (0181) 979 4335.

Despite appalling weather forecasts and a dreary start, the public running day at the Kingfisher Country Club tracksite of **Milton Keynes Model Engineering Society** on the 4th May turned out warm and mostly dry except for one torrential downpour. As the afternoon wore on, the batteries were connected to the signalling system for a trial run. A departure from Lodge Pool is now truly a feast for the senses. 'Gunnison' performed faultlessly all day and everyone had a lot of fun.

The **National 2½" Gauge Association** will be holding their Autumn Rally at the track of Surrey Society of Model Engineers, Mill Lane, Leatherhead, Surrey on the 27th September 1997.

The second model exhibition held by members of **Nuneaton Society of Model Engineers** will be held at the Chilvers Coton Heritage Centre, Avenue Road, Nuneaton, Warwickshire on the 2nd and 3rd August from 10.30am. Attractions include miniature train rides, static displays of clocks, locomotives, traction engines, boats and stationary engines, a Victorian classroom display, photographs and artefacts of old Nuneaton and light refreshments. Admission is just £1.50 for adults and 50p for children.

Members of **Pinewood Miniature Railway Society** have decided on the positions of signals and some of the concrete signal bases have been laid around their track at Pinewood Leisure Centre, Old Wokingham Road, Wokingham, Berkshire.

The opening of the new track of **South Durham Society of Model Engineers** on 4th May 1997 was a great success despite incessant rain while setting up the tent and displays in the morning and a downpour while dismantling everything in the evening. The 3½"/5"/7¼" gauge track at Hurworth Grange Community Centre, Hurworth, Darlington, Co. Durham, was opened by Mr John Lawrie, chairman of the Hurworth Community Association. Clubs attending the event included Carlisle, Tyneside, Sunderland, Cleveland and Wirral model engineering societies and the Teesside Small Gauge Railway, so an impressive stud of locomotives was seen on the steaming bays during the day.

Members of **Stafford & District Model Engineering Society** will be holding an Open Running Day from 10.30am on the 21st September 1997 at their 2½"/3½"/5" gauge raised track situated in the County Showground, Weston Road, Stafford. Anyone wishing to run their locomotives (current boiler certificates are required) should let club secretary Chris Dobbs know beforehand, telephone 01889 270533 weekends and evenings.

Sunday 27th April 1997 saw the first open afternoon of the **Stoford Miniature Locomotive Society** at the society's 650 ft 5"/7¼" gauge ground level track at Henstridge, Templecombe, Somerset. Two locomotives from the Yeovil College society, an 'Ajax' and a battery electric 0-6-0 shared the track with Bill Lupton's Britannia class locomotive, 'Iron Duke'. Some members also did some work on the track as well. The track, situated around a small lake, is to be officially opened on Sunday 21st September when visiting standard gauge and *small* narrow gauge locomotives will be most welcome (boiler certificates are required).

For a short while **Sutton Coldfield Model Engineering Society** has kept a low profile after suffering from the attentions of vandals and thieves. However, the club is now planning its golden jubilee celebrations for 1998 and the anniversary party in June of that year will be a public event with both local and national media.

Civil engineering at the tracksite of **Wigan & District Model Engineering Society** is now all but complete, including the 'bendy' rail into the truck shed. Operation of this device has puzzled several members – what happens to the bit of rail sticking out when it changes from an outside to an inside bend? Simple, have the rail move its unwanted length towards the other end! Its operation is a delight and congratulations to all who schemed it out and got it working. The new steaming bays are ample, the turntable is working and paths have been laid. The work was completed in good time for the Don Young Designs Rally on 1st June, which was a great success.

The 'Spring Meet' held by members of **Vancouver Island Model Engineers** on May 10th and 11th proved to be a really enjoyable event. A total of eleven different locomotives were brought for the run. Fortunately, not more than four were operating at any one time, thus avoiding the congestion which has happened previously.

The **Welshpool & Llanfair Light Railway** will be holding its annual Steam Gala on the 30/31 August in conjunction with the GardenRail Exhibition at the local high school. All of the line's available locomotive fleet will be in steam, including the recently restored 0-4-0 Barclay well tank locomotive, 'Dougal'. One of the line's two surviving Beyer Peacock 0-6-0s, 'The Countess' will be in action over the weekend while 'The Earl' undergoes a major overhaul in preparation for the line's centenary celebrations in 2003. The railway recently received a £495,000 grant from the National Lottery.

Diary August

Details for inclusion in this diary must be received **at least** EIGHT weeks prior to publication. Please ensure that full information is given, including the *full address* of where every event is being held. Whilst every possible care is taken in compiling this diary, we cannot accept responsibility for any errors.

EVENTS OF INTEREST TO MODEL ENGINEERS

A comprehensive list of steam rallies and other preservation events can be found in the *Steam Heritage Museums and Rally Guide 1997/8*, available from TEE Publishing, price £3.50 including postage.

1	CRAMEC, Seen on the Table, Waterside Farm Recreation Centre, Somnes Avenue, Canvey Island, Essex.
1	Maidstone MES, Evening Run and Barbecue, Mote Park, Maidstone, Kent.
1	North Norfolk MEC, Open Meeting/Chat, Social Centre, Avenue Road, High Kelling, Holt, Norfolk.
1	Rochdale SMEE, 'Worm Gears', Talk by J Valentine, Castleton Community Centre, Manchester Road, Castleton, Rochdale, Lancs.
2	SMEE, 'Where Angles Fear to Tread – Experimental Model IC Engine Work', Talk by R A Dunn, Marshall House, 28 Wanless Road, London SE24.
2/3	Brighouse & Halifax ME, National American Locomotive Weekend, 'Ravensprings', Cawcliffe Road, Brighouse, West Yorkshire.
2/3	Nuneaton SME, Model Exhibition, Chilvers Coton Heritage Centre, Avenue Road, Nuneaton, Warwickshire.
3	Keighley & District MES, Open Day, King George V Playing Fields, Marley, Keighley, West Yorkshire.
3	Leicester SME, Open Day, Abbey Park, St Margaret's Way, Leicester.
3	Surrey SME, Maxitrak Owners Club Visit/Rally, Mill Lane, Leatherhead, Surrey.
3	Sutton Coldfield MES, 2½" gauge Rally, Balleny Green, Little Hay Lane, Little Hay, Lichfield, Staffordshire.
4	CRAMEC, Annual Gala Day, Waterside Farm Recreation Centre, Canvey Island, Essex.
4	Peterborough SME, Bits & Pieces Evening, Thorpe Hall, Longthorpe, Peterborough, Cambs.
6	Chingford & District MEC, Driver training/Workshop/Work Night, Ridgeway Park, Chingford, London.
7	Leyland SME, Bring & Buy Evening – 'Never mind the quality, feel the diameter!', The Conservative Club, Towngate, Leyland, Lancashire.
7	Sutton MEC, Bits & Pieces Evening, rear of 1 Chatham Close, Sutton, Surrey.
9	Sutton MEC, Hosts to Gauge 1 and 2½" Gauge Associations, rear of 1 Chatham Close, Sutton, Surrey.
9/10	City of Leeds SM&EE, Rally Weekend, Eggborough Power Station Sports/Social Club, Whitley Bridge, Goole, South Yorkshire.
10	Cambridge MES, Public Open Day, Fulbrooke Road, off Grantchester Road, Cambridge.
10	Wortley Top Forge Model Engineers Fun Day, Wortley Top Forge, Thurgoland, South Yorkshire, off the A629.
12	Dockland & East London MES, 'Stratford Locomotive Works, E. London', Illustrated talk by Mr Stan Hinbest, The Visitors Centre, Belhus Woods Country Park, Aveley, Essex.
12	Sutton Coldfield MES, 'Railway Safety', Talk by John Roaker, Wylde Green Library, Wylde Green, Sutton Coldfield, West Midlands.
13	Chingford & District MEC, Electric Locomotive Night (all gauges), Ridgeway Park, Chingford, London.
13	Hull & District SMEE, Members' Current Projects, YPI Centre, Chanterlands Avenue, Hull, North Humberside.
13	Southampton SME, Barbecue, Riverside Park, off Manor Farm Road, Bitterne Park, Southampton, Hampshire.
14	High Wycombe MEC, Bits & Pieces Evening, Hilltop Community Centre, High Wycombe, Buckinghamshire.
14	North West Leicester MES, Ploughman's Supper, Hermitage Recreation Ground, Hermitage Road, Whitwick, Leicestershire.
14	Sutton MEC, New Drivers Run, rear of 1 Chatham Close, Sutton, Surrey.
15	CRAMEC, 'Power Stations', Presentation by Dave Nunn, Waterside Farm Recreation Centre, Somnes Avenue, Canvey Island, Essex.
15	Rochdale SMEE, Quiz Night, Castleton Community Centre, Manchester Road, Castleton, Rochdale, Lancs.
16	Staines SME, 2½"/3½"/5" gauge Rally, Staines Park, Commercial Road, Staines, Middlesex.
16	Tonbridge MES, Fish and Chip Run, The Slade, Tonbridge Castle Fields, Tonbridge, Kent.
17	Bedford MES, Traction Engine Rally, Rook Tree Farm (Summerfields), near Haynes, Bedford.
17	Chesterfield and District MES, Simplex Sunday, Hady Hill, Chesterfield, Derbyshire.
17	Keighley & District MES, Open Day, King George V Playing Fields, Marley, Keighley, West Yorkshire.
17	South Durham SME, Stephenson's Locomotive Efficiency Trials, Hurworth Grange Community Centre, Hurworth, Darlington, Co. Durham.
18	Peterborough SME, 'The Making and Care of Files', Talk by Mr J Nicholson, Thorpe Hall, Longthorpe, Peterborough, Cambs.
19	Stafford & District MES, Running Night, County Showground, Weston Road, Stafford.
21	Leyland SME, 'Just a Chat' evening, The Conservative Club, Towngate, Leyland, Lancashire.
23	Harrow & Wembley SME, Club Day, Roxbourne Park, Field End Road, Eastcote, Harrow, Middlesex.
23	Sutton MEC, Hosts to Welling & District MES, rear of 1 Chatham Close, Sutton, Surrey.
23-25	Gainsborough MRS, Open Days, Trinity Centre, Florence Terrace, off Sandsfield Lane, Gainsborough, Lincolnshire.
23-25	Ryedale SME, Gilling Main Line Weekend, The Old School, Pottergate, Gilling East, North Yorkshire.
24/25	Cambridge Museum of Technology, Steam Weekend, The Old Pumping Station, Cheddars Lane, Cambridge CB5 8LD.
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24/25	Malden & District SME, August Bank Holiday Track Days, Claygate Lane, Thames Ditton, Surrey.
24/25	Sandtoft Miniature Railway, August Bank Holiday Weekend Open Days, Sandtoft Transport Centre, Belton Road, Sandtoft, near Doncaster, South Yorkshire.
24/25	Southall Railway Centre, 'The Southall Link', adj. Southall BR Station, London.
24/25	Whitchurch (Cardiff) & District MES, Autumn Open Weekend, Heath Park, Cardiff, South Glamorgan.
25	Stockholes Farm Miniature Railway, August Bank Holiday Open Day, Stockholes Farm, Sandtoft Road, Belton, Doncaster, South Yorkshire.
26	Romney Marsh MES, Clockwise Running, 101 Rolfe Lane, New Romney, Kent.
26	Tyneside SMEE, Stationary Engine Evening, Exhibition Park, Newcastle upon Tyne.
27	Chingford & District MEC, Barbecue and Running Night, Ridgeway Park, Chingford, London.
27	Hull & District SMEE, Club Auction, YPI Centre, Chanterlands Avenue, Hull, North Humberside.
28	Sutton MEC, Steam-Up, rear of 1 Chatham Close, Sutton, Surrey.
29-31	Stoke-on-Trent Model Engineers, Opening Celebrations of Phase I of 7¼" gauge Track, Bucknall Park, Bucknall, Stoke-on-Trent.
30	Ascot LS, 7¼" Standard Gauge Rally, Ascot Racecourse (Coach Park 10), Ascot, Berkshire.
30	Frimley & Ascot LC, Fish & Chip Supper, Frimley Lodge Park, Sturt Road, Frimley Green, Surrey.
30/31	Tyneside SMEE, Late Summer Rally, Exhibiton Park, Newcastle upon Tyne.
30/31	Welshpool & Llanfair Light Railway, Steam Gala, Llanfair Caereinion Station, Llanfair Caereinion, Powys.
31	Erewash Valley MES, LBSC Memorial Trophy Event, Fairfax Avenue, Borrowash, Derby.
31	Centre de la Mine et du Chemin de Fer, Model Steam Day, Centre Denis Papin, rue Emile Zola, Oignies, France.
31	Hereford SME, Grand Opening of Broomy Hill Track, adjacent to Broomy Hill Waterworks Museum, Hereford.

Readers' Letters . . . Hints & Tips

Dear Sir

I thought your readers may be interested in the enclosed photograph of my latest locomotive, 'Koppel'. The project began as I was looking through some back issues of *Engineering in Miniature*, January 1991, and saw the three part article 'An Australian Koppel'. I had come to a sticking point with the bevel gears and pinions I was making for my 4" Burrell agricultural engine.

My main interest being 7¼" narrow gauge locomotives, out came the computer for a few trials to see if I could make things fit in with some castings that I had purchased for a Romulus engine. As I had built a Romulus locomotive before, I thought a change would be nice. I checked the outline drawing of the Australian Koppel and found that if I enlarged this drawing by 5.5:1, I would have an engine which I could build using the Romulus castings. The engine has finished up slightly smaller than the Australian engine and my locomotive has Walschaerts valve gear instead of outside Stephenson valve gear.

The engine is 44" long and 21" wide, with cylinders of 2¼" bore by 3⅜" stroke. The axles are fitted with needle roller bearings, while the side rods and connecting rods are fitted with wedges and cotters for adjustment. I started the drawings in January 1995 and the locomotive ran for the first time at Easter, 1997 – pulling passengers on the Sandtoft Miniature Railway – running for about five hours on Easter Sunday and the same on the Monday with two coaches full of passengers, without experiencing any problems.

H Dyson
South Yorkshire

Dear Sir

I have two locomotives in the works that will require large copper boilers 5–6" in diameter and 28" and 34" long. Having built copper boilers for two small(ish) locomotives ('Gemma' and Don Young's 'Marie E'), the experience convinced me that the easiest way to tackle the jobs would be to use oxy-acetylene gear, backed up by a large propane torch. As very little has appeared in the model engineering press concerning the techniques of using oxy-acetylene for copper boilermaking, I was very pleased to find that Alex Farmer's book was being reprinted, so I immediately ordered a copy.

About the same time, the series of articles on boilermaking using oxy-acetylene equipment began appearing in *Engineering in Miniature*. Great, I thought, two different sources of information. Both have been very informative except for one major problem – when stating suggested nozzle sizes for both the oxy-acetylene and propane equipment, both authors use BOC and Sievert trade numbers and, unless one has access to a British Oxygen and Sievert dealer, these numbers are meaningless.

The first run of Mr Dyson's Koppel locomotive.

Could someone please supply a table of BOC tip numbers versus orifice size in inches, millimetres of drill number, and Sievert numbers versus BTU/hr or even nozzle diameter, so that those of us living outside Britain can find equivalents amongst the equipment that is available to us.

I would like to close with a plea to all authors of articles and books on the subject of model engineering. Please remember that you are writing for an **international** readership and that if you quote trade names for a product that you are using, in all likelihood the name means nothing to us in the rest of the world. This is particularly true of trade names that have appeared to have become 'generic' (for example, Araldite, Evostik, etc.). It took many years of reading *Engineering in Miniature* and *Model Engineer* to decipher that these are a two-part epoxy adhesive and a PVA wood glue, respectively!

John R L Purdy
Canada

Dear Sir

One of the many questions we are asked at Greenwood Tools concerns the correct type of tipped cutter for a customer's milling machine. Usually the question goes like this: 'I have a number of steel blocks to machine to size and think it may be worth investing in a tipped facemill for my old milling machine, so how can I be sure that I am buying the correct type of cutter for my machine and for this particular application?'

To answer the question, we would first need to establish the size and power of the machine. If we assume that it is a fairly small milling machine with a ½ hp motor, typical of those used by model engineers, then it would be fair to say that by the time the drive has reached the spindle via gears, belts, etc that 20 percent of the motor power has been lost, leaving 0.4 hp.

When using the rule of thumb that states approximately 1 hp at the spindle will allow one cubic inch of mild steel to be removed in one minute, feed, speed and depth of cut can be easily calculated for a given cutter. For example, to remove 0.040" from a block of mild steel 1½" wide by 4" long in one minute using a 2" diameter facemill with three inserts would use just 0.24 hp.

The other consideration is the stability of the milling machine spindle. The ideal facemill would approach the workpiece at 45 degrees, thus directing the cutting forces up the spindle to the bearing, which would eliminate cutter vibration and lead to longer cutter and machine life. 90 degree approach facemills are to be avoided on light spindles as the cutting forces are against the spindle, leading to vibration and machine wear. However, modern industrial cutters are designed with very high rake angles and these are ideal for the light machines used by the model engineer.

Milling inserts are designed for a very different application to turning inserts, so it would be a mistake to buy a cutter that was designed to take less costly turning inserts.

If you have any questions about turning, milling or drilling, then please write to us or phone 01527 877576.

Darren Maggs, Greenwood Tools
Worcestershire

Unfortunately, an error occurred in last month's *Readers' Letters*, page 32. Ian Amor's telephone number should have read **01872 560803 after 4.00pm**, not as it was published. We apologise for any inconvenience caused.

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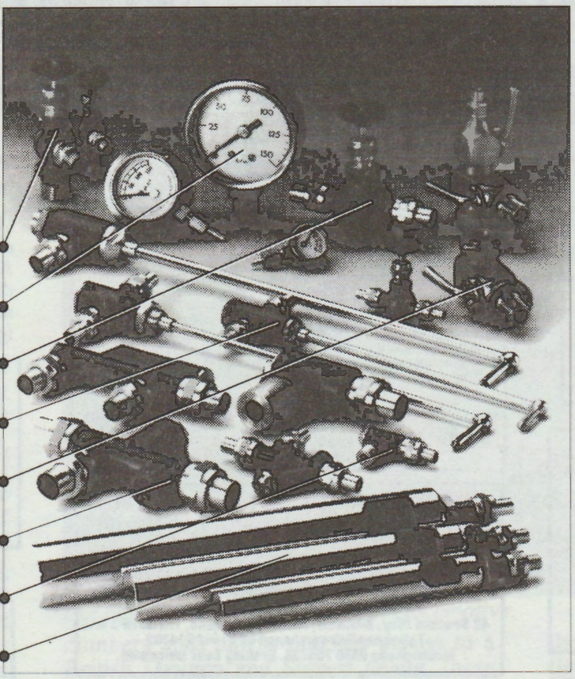

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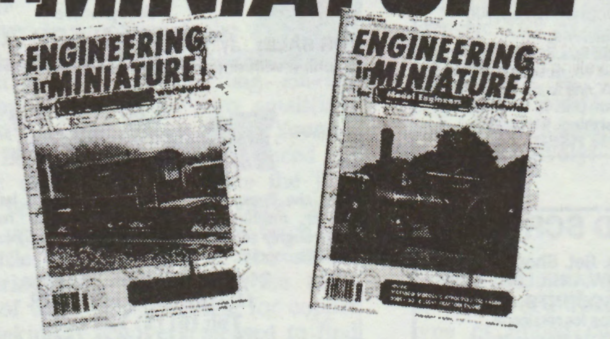

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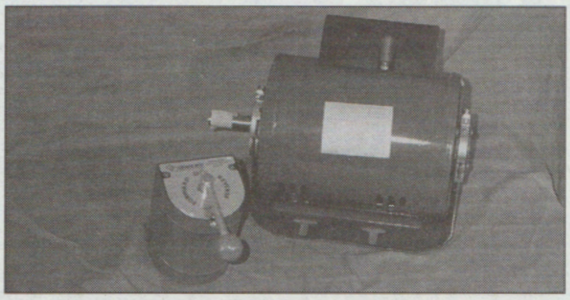

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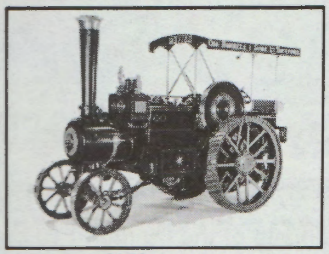

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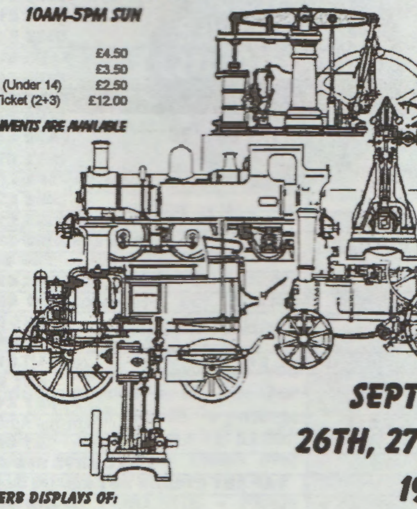

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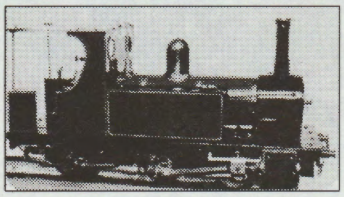

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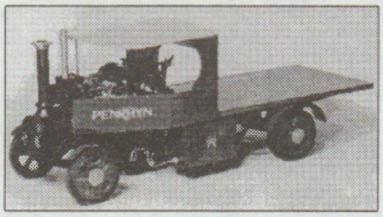

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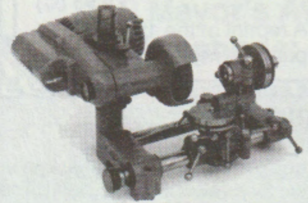

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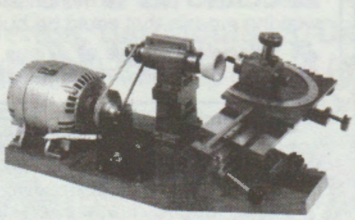

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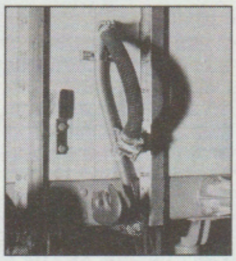

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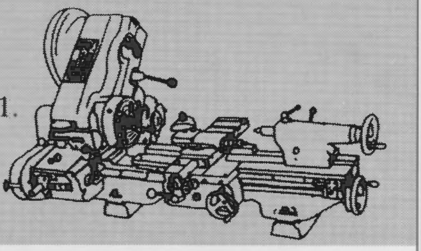

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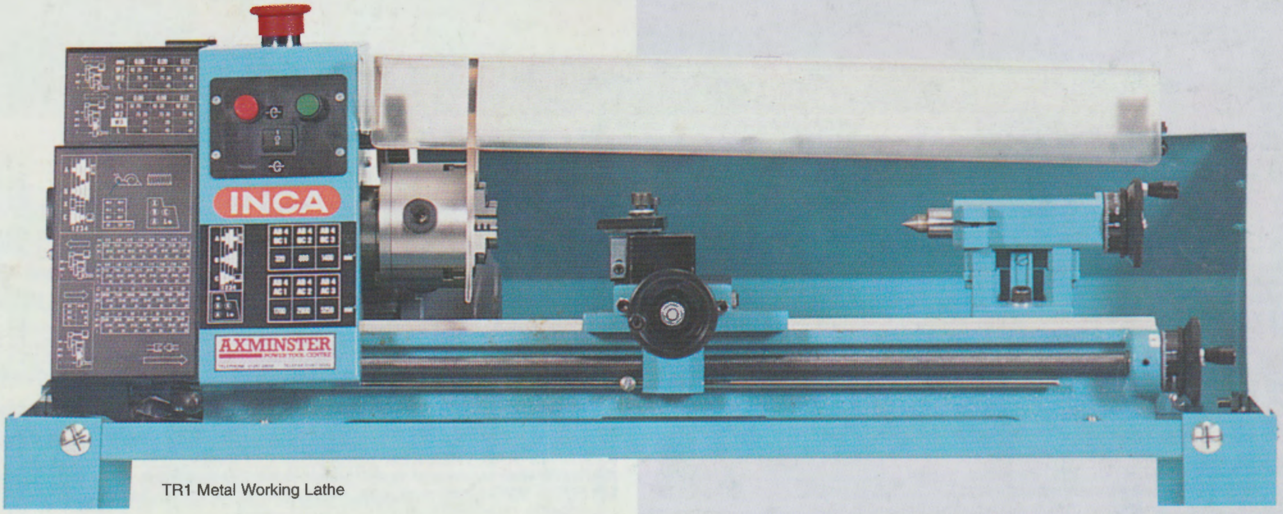

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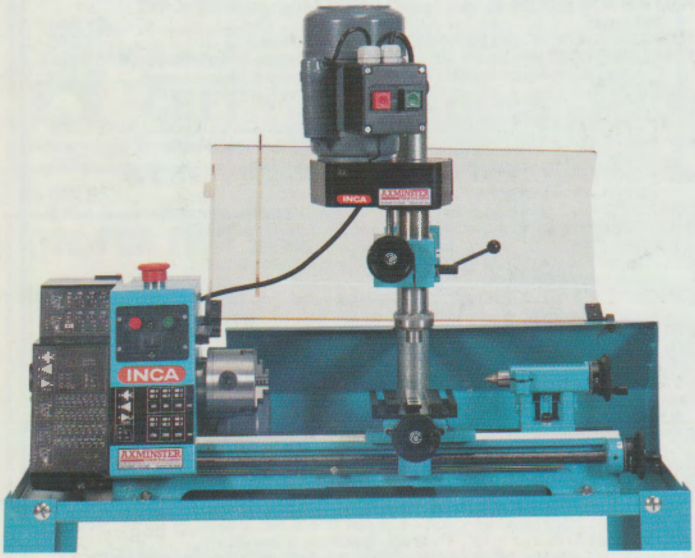

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